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FARMER'S BOOK OF GRASSES

AND

OTHER FORAGE PLANTS,

FOR THE

SOUTHERN UNITED STATES.

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PREFACE.

This little manual has been prepared at the urgent solicitation of many planters for many years. It is written in as plain, simple language as could well be done; so that any intelligent reader may easily understand it all. *Full descriptions* in plain English of all the plants mentioned would have much more than doubled the size of the book; technical descriptions would be hard to comprehend, and hence it was deemed best to give first the botanical name of each plant, so that any desiring, may consult such books as Gray's, Chapman's, or Wood's recent works for fuller descriptions. The more important distinctive characters are given whenever deemed necessary.

Much more time and labor have been expended in collecting and correcting synonyms, and carefully identifying plants by their popular or common names, than in all the other portions of the work together.

A number of plants new or unknown to most farmers have been described at some length, especially when giving promise of much agricultural value. Many others of little worth are mentioned, that farmers may not waste time and money in experimenting with them. Many that are very valuable are too briefly treated because the space assigned me would not admit of fuller detail. And for the same reason many important topics have not been even mentioned.

My own experiences and practises have been given quite freely as requested by friends.

The work has been prepared in the intervals of other absorbing labors, with an average of not less than twenty interruptions for every page. It has been printed from the original rough draft as it has been impossible to find time to copy or revise it. For the same reason a few typographical errors may have escaped uncorrected. In spite of all efforts to the contrary, the work contains over 50 per cent more than the limits assigned me would have permitted.

Should health and leisure permit, I desire at some future time to prepare a large illustrated work on all the Forage Plants of the Southern United States.

D. L. PHARES.

A. & M. COLLEGE OF MISS.
September, 1st., 1881.

ERRATUM:

Page 7, line 5 from top, read pecks instead of pounds.

Farmer's Book of Grasses and Other Forage Plants.

CHAPTER I.

The Pulse Family.

From the oldest records, it is evident that members of this family have been used as food for man and beast from the infancy of the human race. And for many ages other members have furnished timber, fuel, fibrous materials, dyes, medicines and many other products employed in economic uses. This family contains about 550 genera and 7000 species, of which our country produces more than 60 genera and over 200 species. In the limited space allowed in this work only a few of these can be mentioned.

1. Lotus Tribe.

Blossoms butterfly-like, pods not jointed, stems not climbing, cotyledons leafy.

Lupinus. Lupine.

Of this genus, several species are found native; the more common being the *perennial, diffuse* and *villous;* all with generally purplish flowers, rarely white, and woolly pods. While affording some food and worthy of protection, they are not of sufficient value to justify cultivation.

Crotalaria. Rattle-box.

We have three native species of this genus, all with yellow blossoms and dark purple inflated pods. They are low plants, growing on sandy pine barrens and other poor soils, affording considerable food for live stock, where better plants do not thrive. They are sometimes cultivated, only however, for amusement of children.

MEDICAGO. Medick.

1. M. SATIVA. Medick, Lucerne, Spanish Trefoil, French Luzerne and Alfalfa. This plant is very pretty and very valuable. When first brought from South America to the United States, it was supposed to be a new plant and called *Brazilian clover*. A few years ago, it was taken from western South America to California, and thence to the older States as a new plant with its Spanish name *Alfalfa*. But it was known in the earlier ages of the world. By the Greeks (about 500 years before Christ) it was brought from Medea and hence its generic and one of its common names. It has been known ever since in most civilized States, and often mentioned by Roman agricultural writers and by others from their time to this. It is still grown in Persia, where, as in Peru, it is cut throughout the year. It had been cultivated in the southern States 50 years before received from California.

It is ready for use early. Last year I had it two feet high, the middle of February; this year the same height a month later, all the forage plants being late. It should be planted in drills 12 or 15 inches apart, and I think at the very least, ten pounds of seed per acre. The ground should be rich, dry and mellow. The first year it should be cultivated to keep down grass and weeds. The mowing should be made when the first blooms appear, if for hay. It makes a good hay, relished by stock. It is better however, for soiling or feeding green, or rather wilted. For this purpose the cutting should begin before the plant shows any blooms; otherwise, before going over all the lot, some stems become too hard to digest promptly. By the time the last is cut, the first is again ready for the sickle. And thus it may be cut four to six times a year. The amount of rich forage it may produce is probably greater than from any other plant. It is very rich in milk and butter principles, and specially suited for feeding milk cows. For this purpose cut after noon and feed next day.

Stock must not have access to the growing lucerne; for by eating out the crowns, the plants are killed. If protected and manured a little every few years, it will continue a vigorous growth for a life-time. Some plots of it are now in fine condition, that are known to have been growing for over thirty-five years, without any marks of decay.

Where the sub-soil can be penetrated and is not too moist, lucerne sends its roots down 10, 15, even 20 feet deep. Hence it is less affected by drought than any other plant. This should render it specially valuable in the Mission Valley and some other portions of Texas, and perhaps on the skirts of our western desert.

It may succeed well, sown broadcast on well cultivated lands free from seeds of grasses and weeds. In this case full twenty pounds of seed per acre should be used so as to cover the ground early and thus suppress weeds. It may afford good mowings the first year; and these mowings prevent maturing of seeds of noxious weeds.

Every owner of a horse or milk cow should have at least one acre of lucerne. These animals, sheep, swine and poultry recognize the value of lucerne at the first glance.

2. M. LUPULINA is naturalized with us, but is of too little value to require special notice. It is the Nonesuch, or Black Medick.

3. M. MACULATA, spotted Medick, is a valuable plant. It was brought from Chili to California, and thence to the States under the names of California Clover, Yellow Clover and Burr Clover. Many mistook it for lucerne and still so call it. This has only *two or three yellow* blossoms in each cluster, while lucerne has *many blue* blossoms in an elongated head. From the melilots and clovers proper, the medicks are readily distinguished by the pods or legumes being spirally twisted or coiled. That of *M. sativa* is loosely coiled about twice so as to somewhat resemble a rams horn. That of the *M. maculata* is very compactly coiled, so as to present the appearance of a solid oblate spheroid, thickly covered with curved prickles. But seize the prickles at the poles and draw gently; the spheroidal burr is changed to a spiral flat legume with two rows of hooked prickles on its thicker edge.

I have grown this plant about thirty-five years. It furnishes good grazing from February till April or May; a small lot of ground feeding a large number of cattle, sheep, etc. Many think it the best thing possible for grazing and hay. It is the opinion of some, that animals naturally prefer it to other green plants. This does not accord with my experience. They do not incline to eat it at first; but it is easy to teach them, and they acquire a great fondness for it. But all the grass eating animals including geese, etc., know and eat lucerne greedily at first sight. Horses that refuse the spotted Medick when green, eat it readily when wilted or dried. The last lot I sowed was in 1859 or 1860. Every year, many persons passing the public roads near this lot stop and admire the luxuriant growth. For a number of years my live stock had free access to it from December to March, or later, with much profit. On removing them it shot up and spread out rapidly in April and May, in the latter month maturing an immense quantity of seed and then dieing. In June the crab grass (*panicum sanguinale*) sprang up and in August, this grass while in bloom was mowed. In October, I had a second lighter mowing. In a few weeks, the medick would be up and in full possession of the ground till next June. I never

mowed the medick, but to a very limited extent. Thus for years, I had the latter for grazing in winter and spring, and in August and October took off two and a half or three tons of crab grass hay per acre. The hay is better than we usually get from the West.

After a luxuriant crop of medick, the ground is very loose and in condition to produce a good crop of anything else. One may cultivate land every year and make better crops of corn and cotton than on ground not occupied by the medick, and still have the benefit of the latter for winter and early spring grazing. In order to do this, in bedding for cotton and corn, leave between the rows a space four, six, or more inches wide unbroken till the latter part of May, and you will have plenty of seed on the ground to give you a good stand the next fall. Even without this precaution, the lot which I have mentioned has maintained a heavy crop of the medick and for two years made heavy crops of cotton, the latter growing to very large size and fruiting heavily. I had rented it and the lessee broke it up completely, leaving no space to mature Medick seed. This year the plowing of this lot was not begun till May, and the ground was so heavily covered with the plant that the heaviest two-horse plow could not touch the ground till the medick was cut up with a Nishwitz harrow. Those who have not examined it can form no idea of the dense heavy growth. Yet if left alone, it has nearly all disappeared by July, except an inch or two in depth of the legumes covering the ground. A single root will often throw out stems radiating all around and branching so much as to cover a space of eighty square feet. These, though slender, overlapping in every direction and piled two feet deep in May and June render it next to impossible to plow the ground. But by earlier plowing or waiting till July there is none of this trouble. The plant may be recognized at an early stage of growth by the leaf, which is composed of three inversely cordate, rather large leaflets, each having near the middle a dark spot. It is from this spot that the plant receives its specific and one trivial name.

4. M. DENTICULATA. This differs from the preceding in the sharp edged pod being less compactly coiled and having shorter prickles. It is often confounded with the preceding.

5. M. SCUTELLATA, Bee-hive, Snail Medick. This is cultivated only for its curious, large pods, which are coiled like a snail shell with many turns.

As we have no process for removing the seeds from the pods of spotted medick, it is necessary to sow the burr-like pods, say half a bushel per acre. The planting should be done early, in July or August, in order that the tough pods may have time to rot and release the seeds. If covered deep, the seed will not germinate, but remain in the ground for years, to grow when brought to the surface.

Melilotus. Sweet Clover.

Of this we have two species: 1. M. officinalis and M. alba, White Melilot, Tree Clover, Bokhara Clover. They are cultivated for forage; but oftener in the flower garden for comeliness and fragrance. They have run wild in many places, thus adding to the value of native pasturage.

Trifolium. Clover.

1. T. pratense. Red Clover. In a large portion of Mississippi, Louisiana and other southern States, this plant grows as promptly and as luxuriantly, and yields as heavy crops of forage, as in any other portions of America. In truth, from a comparison of the clover crops of Mississippi with those I have seen and had reports of in all the States further north, it is evident that in the former there is much more certainty and less difficulty in obtaining a good catch, and in maintaining a good stand; and in consequence of this, in connection with climatic influences, a larger yield is annually realized, and for a greater number of years, if desired.

True this is putting it pretty strong; but not a whit stronger than, I believe, the facts warrant. I have secured good stands whether the seed were sown in September, October, November, December, January or February; and even to the middle of March. That growing in the field on the east side of the telegraph lines, which so many of you have stopped to admire, and which Northern and Western men have so often gone in to examine closely and handled to be certain that their eyes had not deceived them, was planted five years ago. Yet the hands declare the crop of this year is as heavy or heavier than that of any former year. By special request, I measured a part of this field two years ago, and after thoroughly drying the clover (dryer than I make it for housing) it weighed at the rate of nine thousand pounds per acre. But others, in various and widely distant parts of the State, have done equally well; and some much better, I am happy to acknowledge.

I have been asked many times what fertilizers I applied. All of you perhaps have seen and some of you are well acquainted with every foot of this field, and know that it is old, that the subsoil is a red clay many feet deep, as seen by the cut in the adjacent road, and that there is but little surface soil. It was worn out and abandoned in 1833, the first time I ever saw it. In 1840, having located near by, I purchased and enclosed it for pasture. Thus it was used for years and very much improved. Two years before sowing the clover, I bedded for cotton, and in the beds before sowing the cotton seed, on one portion, I applied Bradley's Fer-

tilizer; on another part Sterne's Superphosphate; on another Dickson's Compound; and on another in the first furrow stable manure, upon which the bed was made. All parts made a good crop of cotton. It has had no fertilizer since. The next year I raised corn on it and a good crop of weeds. In September all the live stock was turned on it for a month. It was then broken and harrowed several times and seeded with clover in November and January. It has had two mowings a year, and more or less stock on it every winter. Yet it is what you have seen. I have other lots of clover equally good, one better.

The first week in April, 1874, a passing plow cut off a clover root. Examining it, I found fifty-six stems from 20 to 25 inches long growing from the one root. It was just beginning to bloom. This some of you have seen as well as other equally interesting specimens. Last year we commenced feeding clover early in April; this year nearly a month later, the season being very unfavorable for early growth. All kinds of farm animals eat red clover very greedily whether green, or dry. I need not tell you of its value for all. This you already know.

Varieties. The *sapling clover* is a very large coarse variety, and not desirable. The *medium* and *smaller*, I think really but one; the difference in size depending on the soil and management. The common medium variety sometimes grows larger than I like. I have no doubt I could make it produce seven tons of cured hay per acre. But it would be coarse, less nutritious and require longer to cure than when lighter. When it yields enough for three tons of dry hay at one mowing, it cannot be cured promptly enough to make the choicest hay, unless the product of one acre be spread over much more ground than it grows on. More can be cured indeed and make excellent hay; but not the best.

Red clover improves land much more than spotted medick both as a fertilizer and ameliorator. Its large tap-root in favorable situations penetrates five to ten feet deep.

The above remarks were made in a lecture in 1875; specimens being in the hands of the audience. The clover was suffered to occupy the land two years longer, or in all seven years. No fertilizer was at any time applied after 1869 as above stated for cotton. The clover was equally good to the last. But prolonged rains and want of time prevented more than one mowing a year for two years; and thus many weeds had time to mature seeds and propagate to a large extent. Two mowings a year seem sufficient to prevent the growth of noxious weeds among the clover.

After mowing in 1877, the ground was plowed and set with sweet potatoe vines in the summer and yielded an immense crop without manure. When the potatoes were harvested in autumn, the field was seeded with red rust proof oats, a small quantity of cotton seed being scattered and plowed in with the oats. The

next spring showed the largest stems and heaviest yield of oats I have ever seen.

Seed per acre. Not less than ten pounds should be used. This may do very well when orchard grass is sown with it, at the rate of four or five pounds per acre. And this is a good combination, as the orchard grass is ready at the same time with the clover for the mower, and it assists in curing the clover more promptly and nicely, though not quite so nicely cured itself in the mixture. When clover is planted alone, I prefer to use twelve or fifteen pounds; or one bushel (sixty pounds) for four acres, or at most five. By using plenty of seed we obtain a better catch, and the increased harvest pays many times over the additional cost of more seed.

Soil. Any good soil with red clay subsoil near the surface is well adapted to clover.

2. T. arvense. Rabbit-foot Clover, Stone Clover. This species is small and almost worthless. The calyx of this and red clover remains erect in seed, while in all the following it becomes reflexed or turned downward. It may be known by the corolla being of flesh color, or whitish with a purple spot, and almost concealed by the plumose silky calyx. The heads are very soft silky-downy, oblong at length cylindrical.

3. T. reflexum. Buffalo Clover. This native plant grows a foot high with very stout ascending pubescent stems and large heads of rose-red and whitish flowers. It is a valuable plant and cattle are fond of it. The large succulent stems and leaves afford so much forage, that it might be cultivated profitably.

4. T. repeus. White Clover. This universally known plant, though perhaps not a native, grows luxuriantly and spontaneously on nearly all deep, red clay lands and furnishes excellent grazing in many parts of the southern States from January on for some months, sometimes through spring and early summer. The later second growth, like that of red clover, salivates horses, mules, and sometimes cows. The flow of saliva is often enormous and very damaging to horses. I have seen but one bad case in the cow. White Clover yields a large quantity of the best honey that can be made. It is however not reliable for this use from the fact that sometimes, without any apparent cause, it disappears almost wholly for one or more years, and then suddenly again covers the earth with a most luxuriant and nutritious growth. I have often had much trouble on account of its persistent, luxuriant growth among other crops where I did not want it.

It frequently starts well into rich growth earlier than the red clover and though soon concealed from sight by the latter, both are unavoidably mowed and cured together, thus giving a hay that will salivate.

I have found that red clover hay of the second cutting, kept a year or more, loses the property of salivating; but whether the same is true of white clover I have not learned. In nutritive value, it is about equal to red clover; as a fat producer much better.

5. T. PROCUMBEUS. Low Hop Clover. This plant is small, spreading, downy and of little value.

6. T. AGRARIUM. Yellow Hop Clover. This is a little larger than the preceding, but not very valuable. Both have yellow blossoms.

7. T. CAROLINIANUM. Carolina Clover, with purplish blooms, is procumbent, small and affords but little grazing.

8. T. STOLONIFERUM. Running Buffalo Clover. This is much like, and may be a variety of number 3 above, but differing by sending out runners.

9. T. MEDIUM. Zigzag Clover. This is only a variety probably of the red clover, from which it differs in having spotless, more oblong, entire leaves and zigzag stems.

10. T. INCARNATUM. Crimson Clover. An annual, maturing earlier than the red of which it is perhaps a variety.

11. T. ERECTUM. Sapling Clover, as stated on a preceding page is a coarse, erect variety of the red clover, later maturing.

12. T. HYBRIDUM. Alsike Clover. This Sweedish species is superior to red clover in feeding value, furnishes more fat and flesh forming materials and less crude fibre. Its yield per acre of hay however is less. It is admirable for grazing. It is slow taking possession of land, but is perennial and does well with orchard grass, both for grazing and hay. It is quite fragrant and a good honey plant. My personal knowledge of it is too limited to estimate properly its true value in the South.

PSORALEA.

Six or more species are native. No common or local name is known to me. These plants furnish considerable forage for live stock; but they are hardly worthy of cultivation.

PETALOSTEMON. Prairie Clover.

We have five or six species, which, though valuable and useful to stock in pasture or forest, are not sufficiently so to assure cultivation.

ONOBRYCHIS SATIVA. Esparsette, Sainfoin.

This perennial, European, pea-like plant has a high character as a feed in France. It is cultivated to but a limited extent in the South. It is worthy of trial as it belongs to a warm climate.

Astragalus. Milk Vetch.

Of these bean-like plants we have five or six species, two of which deserve mention. The *Tennessee milk vetch* and the *Carolina milk vetch* furnish considerable food for cattle and might be improved by cultivation.

Arachis. Pea Nut, Ground Pea, Pinder.

A. hypogæa. This species from South America and the African *Goura* or *Goober* are every where known and much esteemed for the large seeds and the bland oil made from them. But the stems and leaves making an excellent hay, are too often left to decay in the fields. The fodder made from these is very nutritious, valuable and much relished by animals. The seeds are admirable for hogs and other live stock.

II. The Vetch Tribe.

Pods not jointed, two valved; the thick fleshy cotyledons remain under ground in germination; climbing vines; the petiole of the abruptly pinnate leaves terminated by a tendril.

Pisum. Pea.

P. sativum. Common Pea, English Pea, Garden Pea. This species, in its many varieties and uses is so well and universally known that it needs only to be named here.

Lathyrus. Vetchling.

1. L. venosus, and 2. L. myrtifolius, native species are of little value; and L. odoratus, Sweet Pea and L. latifolius, Everlasting Pea are from Europe and planted only for ornament.

Vicia. Vetch.

1. V. sativa. Common Vetch or Tare is much cultivated in Europe for fodder, and to a limited extent in this country for the same purpose. There are two varieties, winter and spring. The winter variety is sometimes planted with turnips and with oats, barley and rye for winter pasture or soiling. My experience with it is too limited to commend it highly for cultivation in this country where other things perhaps more profitable and hardier are in season at the same time with the tares. As a variety it may be cultivated to a small extent as the product is very valuable if not abundant.

V. faba. Bean, Windsor or Horse Bean. This is well known every where and in some regions cultivated for the edible seeds.

3. V. AMERICANA, 4. V. CAROLINIANA, Carolina Vetch, 5. V. ACUTIFOLIA. Acute leaved Vetch, 6. V. MICRANTHA, Small flowered Vetch, and 7. V. HIRSUTA, Hairy Vetch, naturalized, are all valuable wild forage plants. Deer and cattle feed on these greedily and grow fat. Some of these grow abundantly and richly in the southern States and would no doubt give better satisfaction in cultivation than the imported varieties.

LENS. Lentil.

L. ESCULENTA. Common Lentil. This is from Europe and cultivated both for fodder and for the seeds. But it is too feeble and small to yield much of either.

III. TICK TREFOIL TRIBE.

Pod separating transversely into one seeded joints, or having one joint or achene. Stems not twining.

STYLOSANTHES. Pencil Flower.

S. ELATIOR. This is a low herb with trifoliate leaves, and small orange yellow flowers in little clusters or heads; and it is valuable in pine barrens for browsing in heat of summer.

LESPEDEZA. Bush Clover.

1. L. REPENS. Creeping Lespedeza lies flat on the ground covering from three to ten square feet of surface. It will not grow on good soil; prefers indeed no soil proper, but clay and sand. It is utterly worthless.

2 L. VIOLACEA. Purple Bush Clover has an erect, stout, branching stem and varies so greatly with locality that several distinct varieties are named.

3. L. STUVEI. Downy Bush Clover with stem erect, branching, downy.

4. L. HIRTA. Hairy Bush Clover has an erect, wand-like, pubescent stem.

5. L. CAPITATA. Headed Bush Clover has a mostly simple, erect, softly pubescent stem. These last four contain much nourishment in the seed and foliage and grow on sterile soils, where stock that can do no better eat them in late summer, and early part of autumn. Though highly commended by some persons, they are unworthy of notice except on very poor lands.

6. L. STRIATA. Japan Clover. Stock do not relish this plant at first sight; but tasting a few times, they become very fond of it for grazing and hay. In many places, they abandon all the natural pasturage in March, April or May, and confine themselves to this till frost kills it down.

By frequent grazing or mowing it is kept in a growing, tender, palatable, digestible condition. Cattle fatten on it and produce superior milk, butter and beef. And this is just what should be expected when we consider that the justly esteemed red clover contains 16 per cent of albuminoids and 41 per cent of carbohydrates, while lespedeza contains nearly as much albuminoids and 56.79 per cent carbohydrates. Yet planters differ widely as to the feeding value of the plant. Nor is this very remarkable, since this, as other plants, must vary much in economic value according to soil, climate and culture.

In the report for 1878, p. 180, Department of Agriculture, it is stated that, "It is a *tour*, perennial plant, *not rising much above the ground*, but spreading widely on the surface." It is true that it rises little above the ground till May and perhaps throughout the season north of 35° and on poor soils. But in Mississippi from the south-west corner to Brandon, between 31° and 33° latitude it rises in favorable localities to 12 and 18 inches, and is much branched. Here is Mr. Collier's

Proximate Analysis of Lespedeza Striata.

Oil,	3.30	Anylaceous cellulose,	14.67
Wax,	1.10	Alkali extracts,	16.22
Sugars,	14.74	Albuminoids,	15.11
Gum and dextrin,	6.76	Ash,	4.33
Cellulose,	23.77		
			100.00

Analysis of ash.

Potassium,	4.67	Sulphuric acid,	7.82
Potassium oxide,	34.78	Phosphoric acid,	7.54
Calcium oxide,	29.60	Silicic acid,	6.61
Magnesium oxide,	4.75	Chlorine,	4.23
			100.00

There is a good plate of this plant in the report referred to above. In the report, Mr. Samuel McRamsey of Warren county, Tennessee is quoted and says of *L. striata:* "It supplies much grazing from the *first of August* till frost." From this statement it seems that this plant "supplies much grazing" at least four months longer in south west Mississippi than in Tennessee.

It is extremely hardy, readily takes hold of the soil, holds it against other intruding plants and conquers it from many others. By many it is said to eradicate the broom grasses (Andropogons).

One serious objection to it is that it kills out Bermuda grass. This however, will commend it to some. It grows well on and completely hides any soil; in washes, which it arrests; and in pine thickets, where nothing else will grow.

It compares very favorably with red clover as a fertilizer, the above analysis of the ashes showing nearly 40 per cent of potas-

sium and its oxide besides a large quantity of phosphoric and sulphuric acids brought up from the subsoil in addition to the large per centage of plant food which it condenses from the atmosphere.

We have so many genuine clovers, which belong to the *Lotus* tribe, that it is to be regretted that the Lespedezas which belong to the *Tickseed* tribe, should ever be called a clover.

The hop clovers are often mistaken for Lespedeza. The former however, have yellow blooms in conspicuous heads and die down in June; while *L. striata* continues through the summer, producing very small purple, rose, or perhaps more properly pink colored blooms in the axils of the leaves in September. Some years a few precocious blooms are seen early in June. The plant produces many seeds, only one, however, in each little pod.

Where it grows well, it has much root and is difficult to plow under and to kill. It is also difficult to burn after being cut, and may become troublesome to careless farmers.

How this plant some thirty years ago came from Japan is unknown. But for 15 years it has been rapidly spreading over the southern States east of the Mississippi river. When the old genus Hedysarum was divided, to those plants having a one jointed one seeded pod or akene was assigned the generic name in honor of Lespedez, a governor of Florida while under the Spanish rule. The other plants of the old genus having flat legumes with two to six joints breaking at maturity into as many akenes each with one seed were assigned to the genus *Desmodium*.

Within a few years the *L. bicolor* has been introduced from the Amoor river region, northern Asia, as a late summer and autumnal ornamental plant. But this two-colored lespedeza can never become a useful forage plant.

DESMODIUM. Tick-seed, Beggar Lice.

We have about twenty native species of Desmodium. Many are hard, woody and nearly worthless. Several however, have long been known as supplying rich food for deer as well as domestic animals. These plants contain a large per centage of nutritive matters as shown by Mr. Collier's

Proximate Analysis of Desmodium from South Carolina.

Oil,	2.35	Anylaceous cellulose,	14.39
Wax,	.44	Alkali extracts,	7.04
Sugars,	13.46	Albuminoids,	21.22
Gum and dextrin,	8.15	Ash,	7.56
Cellulose,	25.39		
			100.00

Analysis of Ash.

Potassium,	6.33	Sulphuric acid,	5.10
Potassium oxide,	27.81	Phosphoric acid,	11.87
Sodium,	.56	Silicic acid,	11.19
Sodium oxide,	——	Chlorine,	6.61
Calcium oxide,	23.42		
Magnesium oxide,	7.11		100.00

Mr. Collier does not name the species analyzed. He calls special attention to this analysis, adding: "By reference to the analysis it will be at once seen how large an amount of albuminoids is present; and for the purpose of comparison the analysis of red clover is placed below with that of this plant.

	Desmodium, per c.	Red clover, per c.
Carbohydrates,	45.83	41.00
Albuminoids,	21.22	16.01
Cellulose,	25.39	35.01
Ash,	7.50	7.08
	100.00	100.00

"For convenience of comparison, the carbohydrates are grouped together. It will be seen that the albuminoids of the Desmodium are to those in red clover as 132 to 100, while the amount of ash varies but slightly in the two plants. The immense value of clover as a crop preparatory to other crops, especially wheat, is well known, and there is perhaps no way by which exhausted lands may be more readily restored to fertility, and maintained in such condition, than by the use of clover; certainly there is no method which compares with it in expense. Now, although clover requires an amount of plant food, both mineral and atmospheric, far in excess of a wheat crop, nevertheless it is a fact very well established that the former crop may be successfully grown upon a field where wheat would invariably fail of a crop.

"The reasons for this are to be seen in a comparison of the two plants; and, although it is a 'thice-told' tale, the subject especially in connection with this plant under consideration, is such that every farmer should practically understand the matter.

"Clover and wheat, then, belong to two families of plants, which in nearly every respect are in the strongest contrast.

"Clover is one of the dicotyledonous, or those of which the seed is divided into halves, as with the pea, bean etc. These plants are characterized also by a strong tap-root, which, descending into the subsoil, enables the plant to secure nourishment from beyond the reach of plants of the other sort.

"Wheat, on the contrary, belongs to the monocotyledonous plants, the seeds of which are not so divided in halves, as Indian corn for example. The roots of this family of plants are surface or crown roots, and are destitute of the tap-root already spoken of.

"Again, if we consider the habits of growth of the two plants, we have in clover a plant of continuous growth through out the season until cut down by frost or the scythe of the mower, and an enormous leaf development, as compared with wheat with its scant leafage and its short life. We have, then, in clover a plant with a tap-root and an enormous root development, enabling it to seek out and assimilate mineral food, with a great extent of leaf surface, fitting it to take in and assimilate atmospher-

ic food; a long period of growth, which causes it to appropriate the greatest amount of both kinds of food and store them up in root and stem. In wheat, on the other hand, we have a surface rooted plant, a scanty leafage, and a short period of growth. What wonder, then, that so coarse a feeder as clover should thrive, even where so dainty a plant as wheat should utterly fail, as is so often the case? But, as will be remembered, all this atmospheric and mineral food, which has been assimilated and stored up in the roots and stems of clover remains to furnish an abundant supply, by its decay, to the crop which shall succeed it, and thus clover or similar plants have always played a most important part in all systems of rotation, as in the wheat growing region of the Genesee valley of New York. In this Desmodium we have a plant which appears to be a substitute for clover and to possess this great advantage, viz: that it will flourish vigorously upon certain lands upon which a crop of clover can not be secured. This seems to be especially true of the sand barrens of the Atlantic seaboard. Certainly if the statements made concerning it are to be credited, it is destined to effect a revolution in agriculture throughout this section, and to restore to fertility lands which have been partially abandoned by the former."—Dept. Ag., Report for 1878, pp., 182, 183.

Mr. Collier's reasoning is just. But the Desmodiums are so light and so diffuse in growth that I think the quantity per acre would be small. In soils mentioned they would act as described, but the plant food they could bring from the subsoil and store from the atmosphere would be comparatively little. On the same kinds of soil, I opine, the *Lespedeza striata* would grow well and obtain and store plant food in the ways mentioned by Mr. Collier, and in larger quantity than the Desmodiums could. The Lespedeza possesses other properties which would give it preference on the soils and for the purposes contemplated. The growth is so dense as to completely blanket the earth for the hot months, protecting from washing and by the dense shade preventing evaporation of fertilizers and promoting absorption from the atmosphere. A great objection to the Desmodium too is the fact that the hispid jointed pods adhere to the coats of animals and people.

RICHARDSONIA SCABRA. Mexican Clover.

This is a native of Mexico and South America. It has become naturalized in Florida and the southern parts of other southern States. It is called Mexican Clover, Spanish Clover, Florida Clover, water pursley, bellfountain, poor Joe, pigeonweed etc. The analysis of this plant, made in 1874 by Mr. Mc-

Murtrie, shows it to be equal to clover as green food, or hay. It is as follows, being thoroughly air dried:

Oil,		1.50
Gum.	carbohydrates,	13.80
Sugar, dextrin etc.		12.80
Starch,		11.00
Chlorophyl,	nitrogenous compounds,	5.20
Gluten,		0.90
Albuminoids,		9.60
Cellulose,		33.30
Inorganic matter,		11.90
		100.00

The reader may compare with the analysis of red clover. The analysis of the ash gave

Insoluble silica,	22.740
Soluble silica.	2.740
Lime,	29.456
Magnesia,	1.605
Phosphoric acid,	7.457
Peroxide of iron,	trace
Sulphuric acid,	2.617
Chlorine,	2.840
Potassa,	23.824
Soda,	6.860
	99.639

This plant grows luxuriantly on our southern, sandy pine lands as well as red clover does on rich land and yields as much green or dry food. It attains a length of three to six feet and may be mowed and fed green, or dried in the same manner as clover in order to save the leaves. When the land is once set with it, it springs up from seed early in spring. Crops may be cultivated on the land; and if laid by before July, this plant springs up and soon covers the ground. It is relished by horses and mules, cows and sheep.

Penetrating the earth deeply with its roots, it bears drought well and brings up from the subsoil and prepares in roots and stems most valuable fertilizers; being rich in lime, phosphoric acid, and remarkably so in potassa. By its dense shade in the heat of summer the soil is protected, evaporation of volatile fertilizers prevented and plant food absorbed from the atmosphere. The physical condition of the soil and subsoil also is improved by its roots. In all these particulars its action is very similar to that of red clover.

It is not known how far north it will flourish; but it is probable that on all the sandy pine lands of the States bordering the gulf, it will prove a very profitable crop for feed, fertilizing and soil-ameliorating purposes.

Medicinally it is said to be used in Jamaica as a substitute for ipecac and is there called white ipecac. In 1863, while superintendent of the laboratory at Mobile for preparing medicines for the southern army, Dr. Rohmer prepared and furnished the powdered roots of this plant to the surgeons, who testify that "it answered every purpose." It belongs to the order Rubiaceæ with coffee, madder, ipecacuanha, cinchona and other medicinal plants.

A heavy crop of this plant, plowed under in the fall just before frost or immediately after being killed, should be followed the next spring by tobacco, corn or potatoes.

IV. THE BEAN TRIBE.

These are mostly twining herbs bearing two-valved pods, not jointed. The fleshy cotyledons rising above ground in germination. We have seven native genera of this family.

PHASEOLUS. Bean, Kidney Bean.

Of this we have four natives: P. PERENNIS, 2. P. DIVERSIFOLIUS, P. HELVOLUS and P. SINUATUS, plants of considerable value for cattle.

Of the more valuable cultivated species may be named P. VULGARIS, Common Kidney, String, Pole, or Snap Bean; P. NANUS, Dwarf or Field Bean; P. LUNATUS, Sieva, Lima or Butter Bean; all much esteemed for the table; the green pods of the first two and green seeds of the last being used. In this connection may be mentioned also P. MULTIFLORUS, Scarlet Runner or Spanish Bean, with many showy white or bright scarlet flowers; and P. CARACALLA, Snail Flower; the latter of little use, the former valuable for table and forage. There are many other cultivated varieties.

DOLICHOS.

D. LABLAB, Egyptian or Black Bean from India, and D. CHINENSIS, China Bean with its variety *melanophthalmus*, Black-eyed Bean are useful cultivated plants. Our native species D. MULTIFLORUS, Many flowered Bean, somewhat rare, might be cultivated.

Our native *Galactias*, Milk Pea, *Clitoria*, Butterfly Pea, and *Centrosema*, Spurred Butterfly Pea are common and valuable, but they yield too little to justify cultivation.

SOUTHERN FIELD PEA.

Of all the varieties of Beans, however, there are none more valuable than most of those known in the South under the misnomer "*Field Pea.*" Of these there are many varieties. A va-

riety with rather small yield of vine, but an abundant yield of small white seed, which whether green or dry, when cooked afford a delicious tender dish. Another white variety with larger seed and more vine is also an excellent article for the dinner table, but not so nice as the former.

The "Whippoorwill" with larger, mottled seeds of early, rapid growth and may be mowed several times; or when a few seed mature the whole may be plowed under and soon another crop covers the ground.

The Red Ripper, Black, Cow Pea and others yield a heavy crop of seed and hay. They should always be sown among the corn broadcast or drilled each side of the corn row at the last working. I always prefer laying by corn as early as possible in May; both for a better corn crop and for obtaining a heavier growth of the pea vines. Peas sown in June rarely yield half so much vine and leaf as those planted in May. Those planted in July grow but a few inches high. I plant rather for the leaf and vine, of which I wish the largest possible growth both above and in the ground; the root to release and bring up potash, lime and phosphorus from the deeper subsoil and render the latter friable; the vines and leaves to shade as densely as possible at the time, (July, August and September,) when the earth so shaded absorbs with most avidity fertilizers from the atmosphere in addition to the quantity assimilated by the plant itself.

These field peas should be sown on all stubble lands also, as soon as the grain is mowed, either broadcast or plowed under; or if seed be scarce, drilled in every fourth or fifth furrow. In the latter case they may be cultivated. By thus following the crops of grain with peas the land may be continually improved. After a single good crop of peas, even when mowed or pastured off, I am confident I have seen the yield of the next cotton crop increased fifty or one hundred per cent on clay soils.

As a food crop they cannot be too highly prized; they, like small grain and grasses, require no labor except sowing and harvesting. A hand will pick as many pounds of peas as of cotton in a given time. Peas rarely sell for less than one dollar per bushel, oftener for more; and as during the current year the purchaser sometimes pays three dollars per bushel. They are cheap at the highest price for fertilizing alone. Every one should save at least enough seed for his own next year's planting.

In some parts of the country peas are very often much damaged by the pea weevil, or bug. This may be obviated by letting them remain in the pod till ready to use; or when well dry by threshing on dry dusty ground and gathering up dust with the seed. If threshed by machinery, dust or ashes may be supplied while putting in sacks, barrels or bins. Any air tight package will prevent insect depredations. But if put up in air tight packages, they must be free from moisture.

A serious objection to keeping in pod till ready to plant is that in the spring when the air becomes warm, the pods are infested with numerous mites. When animal or person then touches the pods, the mites attack the intruder, penetrate the skin and produce an intolerable itching that will sometimes render person or animal frantic with pain.

For feeding during the cool months, I much prefer them in the pod. If improperly fed, however, to a hungry animal he may become choked; if free from hull, he will eat too rapidly and will have colic. An animal that is to have a feed of dry peas should first be watered, then take a handful of pods, giving him one at a time; after which there is no further danger.

Peas should yield as many bushels as corn on the same land if properly planted, cost much less to produce and always sell for more. Or again; on two plats of land of the same quality planted in cotton and peas the crop of peas will pay many times more than the cotton in proportion to expense of production.

Now a word as to pea vine hay. This is not difficult to cut with the hoe or scythe if in drills; nor with a good mower if broadcast. It is easily raked into long piles or larger rounded ones, with the horse rake of proper construction. It requires, it is true, more time and care to cure well than grass; packing loosely, it is more bulky and difficult to handle. Yet it is highly relished by all live stock and is worth much more than all the labor and expense of saving. When sufficiently dry it must be protected by a roof sufficient to turn all rain. It may be housed in rail pens with rails for open floor a foot above ground and others every few feet above; or in houses with rails, slats or poles above ground and six to twelve inches apart for it to rest on and then poles through at intervals. In this way it may be cured in fine condition though housed when but half dry. Ventilators may be made by nailing together three or four planks to form a tube extending from the floor upwards as high as necessary. After filling the house these tubes may be withdrawn for use in another place.

It should have been mentioned that peas fed in the pod are excellent for sheep; and a few daily will keep them in fine condition during our severest winters.

The analysis of the pea and vine confirms the practical observations of feeders and farmers as to the value of both as food for animals and land. While containing less fat, they contain much more of the other and more valuable nutritive matters than any of the other forage crops. They contain also more ashes peculiarly rich in potash, lime and phosphoric acid, besides plenty of soda, magnesium and sulphuric acid.

Glycine hispida. Japan Pea.

This bean (it is not a pea) came under my observation some twenty-five years ago, as the Japan Pea. It was then cultivated to a limited extent for a few years; but ceased to attract attention till the close of our civil war; when it was again widely sold as the Southern Relief Pea. The catalogues name it *Soja hispida*. Though not a climber, it may be the *Dolichos Soja*, or Soy bean of China and Japan.

In this country, this bean is probably not esteemed so highly as it should be either for the table or for forage. Few people bring it to the table more than once; for when prepared as other beans it is inedible and disgusting. But when the ripe seeds are soaked from twelve to twenty-four hours they may be cooked so as to afford a most delicious and nutritious dish. The soaking changes the shape of the bean from globose to oblong.

The plant is erect, three or four feet high, much branched, bearing much foliage and a large number of few seeded pods. Live stock are fond of it. But when old it contains much hard woody fibre and the seeds are very hard and dense.

For forage, it should be cut before it ceases blooming; and it should be rapidly cured, not too dry to prevent loss of foliage. As it does not pack very closely it can be housed less perfectly dried than many other forage plants.

It grows rapidly and may be planted any time from April till July inclusive. On ground as prepared for other beans, corn or cotton, plant in rows three feet apart, having the plants one to two feet apart in the rows; or in checks three feet each way with two or three plants in each check. Cultivate as corn or cotton.

This is probably the Sooja or Miso of Japan so much used in soups in that country. The soy or sauce made from these seeds is used three times a day, as salt with us, in nearly all dishes. The favorite Chinese curd-like dish, *Tau hu*, also is made of these beans.

CHAPTER II.

Composite Family.

This family is very large, containing one-tenth of all known species of flowering plants. Few of them are valuable as forage plants, some as human food, many as medicines; most of them are troublesome weeds and many of them pests on the farm. Only a few will be mentioned here.

HELIANTHUS.

H. ANNUUS. The Sun Flower leaves contain considerable nutritive material; and the seeds are very rich, especially in oil of a bland character. They are better food for poultry than for large animals. The plant is coarse, large and not sufficiently productive to be desirable as a farm crop.

2. H. TUBEROSUS. Jerusalem Artichoke is more valuable than the preceding. The leaves are nutritious and relished by stock. The plant is cultivated, however, more for the tubers, which are produced in large quantities with little cultivation. They are wholesome, valuable food for stock. They remain in the ground without rotting or damage, and may be gathered by hogs at will.

The tubers for planting should be cut in the same manner as Irish potatoes and planted like the latter or like corn from one and a half to three feet apart in the rows. The rows should be from three to six feet apart according to quality of land. They may be planted in fence corners; and the hoeing to keep the fence-row clear of weeds will make the crop. In fence corners once planting is usually sufficient for annual crops. Though hogs be turned on them, enough will be left for another crop from year to year. In the plowed land they should be cultivated like corn. The plants grow rapidly and require little attention. On good land the sun flower and artichoke both produce very large tall woody stems, those of the latter more branched. Where fuel is scarce and very costly, as on large praries, these plants may be profitably cultivated for fuel as well as food. This fuel is more especially adapted to use in the cooking stove. Being very rich in potash, the ashes should be returned to the soil.

ACHILLEA.

A. MILLEFOLIUM. Yarrow, Milfoil. This plant is commended by foreign writers as valuable in pastures. But its value probably consists mainly in its aromatic, bitter, tonic properties. But in this country, live stock usually find enough tonics in other plants to serve all the requirements of health.

CICHORIUM. Succory.

1. C. INTYBUS. Wild Succory, Chiccory. This plant also is commended by foreign writers for forage. But as it imparts a bad taste to milk and has no great nutritive value, it should be excluded from our pastures and fields. The sole use, for which it is cultivated in the United States, is for adulterating coffee, the roasted root being the part employed. As it has not the properties of coffee, the practise is a base fraud, a criminal swindle, from which the poor especially suffer.

2. C. ENDIVA is the Endive or Garden Succory, the blanched radical leaves of which are used as a salad.

CHAPTER III.

Plantain Family.

This family furnishes no plant of much value for forage or food of any kind.

PLANTAGO. Plantain.

P. MAJOR. Greater Plantain, Way bread is diffused nearly all over the world, following the foot-steps of man every where. It is of so little value for live stock that I would prefer not to have it in my pastures. It was long esteemed as an application (the leaves being used) to blisters, scrofulas, tumors and ulcers. Thus Shakspeare:

> "*Romeo.* Your Plantain leaf is excellent for that.
> *Ben.* For what I pray?
> *Rom.* For your broken shin."

It has recently attracted much attention as an antidote for the poison of snakes, the juice being taken internally and applied locally. But it is probably most valuable as a forage plant for birds, the spikes of seeds being gathered for cage birds.

P. LANCEOLATA. Buckhorn Plantain, English Plantain, Ribgrass. This is eaten by all live stock. In Great Britain it is planted for sheep pasture especially. On poor lands it may be tolerated; but it is of too little value in our country to be encouraged, except for the amusement of children, who delight in striking off the short spikes or heads, called "bullies" or "sodgers." The seeds are relished by birds.

CHAPTER IV.

Borage Family.

SYMPHITUM ASPERRIMUM. Prickly Comfrey.

This plant, a native of Caucasus, was brought to England in 1811 as an ornamental plant. Later it was cultivated as a forage plant to a limited extent, but was not esteemed by English far-

mers. In Ireland it was grown more extensively and found quite valuable for dairy cattle. The bishop of Kildare was especially conspicuous in its culture at Glassnevin. On the Carew castle farm, the experiments showed a yield of forage reported at 82 tons per Irish acre:—28½ tons in April, 31 tons in July, and 22½ tons in September.

A few years ago, Mr. Ashburner of Virginia introduced the best variety of prickly comfrey into America. From him, as soon as possible, I obtained root cuttings and have grown it ever since. Some of the first plants obtained remain in full vigor—all perhaps that were not divided, nor permitted to seed.

An analysis of the comfrey, made by Voelcher, gave the following results—the plant taken in green state and also dried at 212° F.

	Natural state.	dry.
Water,	90.66	
Nitrogenous, or flesh forming matters, (containing nitrogen 4.34)	2.72	29.12
Non-nitrogenous, or heat and fat producing compounds,	4.78	51.28
Mineral matter, (ash)	1.84	19.60
	100.00	100.00

A more minute statement of the analysis of Voelcher gives:

	Natural state.	dry.
Water.	90.66	
Oil and chlorophyl,	.20	2.20
*Soluble albuminous compounds,	1.10	11.81
†Insoluble " "	1.62	17.31
Gum. mucilage and Sugar,	1.28	13.65
Woody fibre (cellulose)	3.30	34.43
Mineral saline matters soluble in water,	1.25	13.32
Mineral matters insoluble in water,	.50	6.28
	100.00	100.00
*Containing nitrogen,	1.75	1.88
†Containing nitrogen,	2.59	2.78

Like many other forage plants, comfrey, in a green state, contains a very large per cent of water. It is extremely rich in mucilage and contains the essentials for forming flesh and milk in abundance with little increase of oil or butter. Hence when milk is too rich in oil or butter to be wholesome, as often occurs in the Jersey cow, feeding comfrey would reduce the excess of oily matters in the milk and increase the quantity of the latter.

I find it excellent for *nursing sows*, and indeed for all kinds of hogs, cattle, horses, mules etc. Pigs for slaughtering, fed freely with comfrey and sweet potatoes with a little corn or meal, furnish probably the most deliciously nice pork that can be produced by any feed whatever.

Having a long tap root, comfrey is little affected by prolonged droughts. In 1879, we had a long drought terminating the last day of May. Pastures were parched, streams and springs dried up; but the comfrey flourished, and on the first day of June we commenced cutting the fourth time since March. At such times it is extremely valuable for all farm animals; but especially for hogs and cows. It may be cut six or eight times a year; and if the seasons are very favorable perhaps ten times in my locality.

It is said to yield on rich land eighty tons per acre; and thirty tons is probably a medium or moderate crop. I do not doubt the estimate of the Carew castle farm crop. On good land the broad leaves may attain a length of three feet and form an immense conical pile for each plant. Like other things of value, it requires some work with attention and patience; and without these, one would better not touch it or any other crop. From one-fourth to one acre, on every farm properly managed, cannot be better occupied.

Comfrey can be propagated from seeds, root cuttings, crown-cuttings and stem-cuttings;—the seeds and roots being best. The seeds may be sown in autumn, winter or spring. If planted early they may not appear till spring. They should be barely covered with soil. The roots may be cut in pieces an inch long and the larger ones may also be split in two or more pieces and set almost any time if the ground is sufficientiy wet;—but best from Febuary first till April. I speak with a view to my own experience in latitude 31°. The plant is perennial and requires little cultivation after once getting rooted. For large crops it must be manured whenever the yield falls off too much.

The ground should be well broken and as deeply as possible with convenience. The distance at which the cuttings or plants must be set will depend on the quality of the soil and the preparation. Two feet by one and a half would require 14,520 plants per acre; $2\frac{1}{2}$ by $1\frac{1}{2}$ feet, 11,600 plants; 2 by 2 feet, 10,890 plants; and $2\frac{1}{2}$ by 2 feet, 8,712 plants. This is as close as I would advise to plant; and on very rich land I would have the plants three by three feet. Mr. Ashburner recommended setting the cuttings very deep in the soil, and following his instructions in a heavy soil, many of my cuttings never got out. Four or five inches may do in very light soil, but in very heavy soil one inch is much better.

Most animals require some training to learn the value of this plant and to acquire a relish for it. But when they do eat, and it requires but little effort to induce them to try it, they become excessively fond of it. I have never found it necessary, as practised by some persons, to confine animals to make them eat it, nor to mix it with other food. If hungry, the animal may be more ready to taste; but even when full, they have been indu-

ced to test it. With a hand full of leaves, go among your animals; if one will take a leaf, others from jealousy will come and try one. If this does not succeed, have with your comfrey, some other green plant that will be readily taken, only enough to give one animal a mouthful. Others seeing the one eating will come and try the comfrey. A few trials will get up a lively competition for what they soon regard as a choice luxury. They may at first nibble daintily; but soon eat greedily. Poultry also may be taught to eat it with great benefit,

It is a very wholesome food and very valuable medicinally in inflamations of the mouth, throat, stomach and bowels; and may be used as an external local application in wounds and other injuries that become very hot and painful.

CHAPTER V.

Convolvulus Family.

This family embraces a number of genera and species native in the south; some ornamental, as the quamoclits or cypress vines, morning glory etc.; others are pests as the bind weeds, tie vines and dodder or love vine; a few are medicinal; and two or three useful for food, as the hog potato and sweet potato. Only the last will be considered in this connection.

IPOMEA.

I. BATATUS, or BATATUS EDULIS. Of the sweet potato there are very many varieties, in which the forms of the leaves differ very greatly. The shape and size of the tubers differ greatly also, as well as the color of the epidermis or skin and of the flesh. The texture and flavor of the edible part differ much too in the varieties. Some contain apparently no sugar, others a large quantity. All are highly valuable as food for man and beast. Horses, cows, sheep, swine, poultry and many wild animals are very fond of them and they are superior food for all.

The pork, bacon and lard made from swine fattened on sweet potatoes are *firmer, whiter, sweeter, less disposed to become rancid* and are easier to cure than the same products from any of the grains or other foods. In the south, every farmer should produce enough sweet potatoes to make them a large constituent in the rations of his family and all his live stock. If he has not enough to fatten his hogs, he should at the very least furnish them abantly during the last eight or ten days of the process. This will greatly improve the quality of the products.

The potatoes may be fed to swine raw, but better cooked. Unless very small, if fed raw, they should always be cut or sliced

with a root cutter. Otherwise animals are liable to choke; but this is not the only or principal objection to feeding whole. There is great waste in several ways in feeding whole large potatoes and that is the sort all should produce. But it is cruel to feed them whole; for in attempting to bite off pieces the gums of the animal (even of the hog) are often badly lacerated and the blood flows freely. No animal can be benefitted under such suffering however fed otherwise.

For milk cows, potatoes are very profitable in combination with hay, grass and other foods. They improve the appetite, digestion and condition generally.

For the horse there is no better food than sweet potatoes. In a warm climate, even in winter, I should say if a horse is to be deprived of corn or potatoes, let him have the latter. The rider or driver will soon discover that the animal has a softer smoother coat, a healthier skin and secretions, more life, elasticity and bottom than when fed on corn; that he will endure more hardship, render more service and last longer.

For the table, we have nothing that may be prepared in a greater variety of ways or that can furnish a greater number of appetising dishes than the sweet potato; to say nothing of its many other uses in domestic arts and medicine.

The vines. As fodder, nothing can be found richer, better, or more relished by live stock. Even when thickly covered with mould, they are readily eaten by animals. They are full of rich, starchy, sugary gum and milk and consequently very difficult to cure—cannot be dried at ordinary temperatures.

When ready to harvest the crop, a very large plow may be used to tear off and heap the vines. These vines may be hung on fences, stumps, rails, poles or under open sheds and thus partially dried. Those exposed to rain or dew should be used first; and those under shelter reserved indefinitely for emergencies during winter. If not convenient to gather the vines; long before harvesting the roots, calves and colts, or a milk cow or two may be turned on the vines an hour or more daily with much benefit to the animals and little detriment to the tubers if the growth of vines be rank.

Cultivation of the Sweet Potato.

A variety suitable for the purpose contemplated should be selected. If for the table, none can surpass the old white or rather creamy yellowish yam with deeply lobed leaves and slender vines. One or two other varieties are nice for the table, for starch and other purposes. But it is for stock food that we are to consider it here. The red or *Cuba yam* is approved by many because it is early, attains large size, mostly rounded and yields an abundant harvest. It however, contains less nutritive matter and more

water than any other variety that I have examined. Hence I object to it. It has so little solid matter that it may be cooked through in one-half or one-fourth the time required to cook some other varieties.

The *Bermuda* is another red variety with mostly elongated brittle tubers—very many of them breaking in harvesting and the skin slipping off easily on prssure. Yet I prefer this to the preceding. It yields largely and is more dense than the Cuba in texture.

The *Shanghae* has a white tuber very hard, rather insipid, sometimes with much woody fibre, few rounded, but rather inclined to elongate indefinitely, gradually diminishing in size as the roots of a tree. It yields largely of both vines and tubers. In harvesting the tubers are broken, the milky gum probably combined with some resin adheres tenaceously to the skin and whatever else it may come in contact with, and it is very difficult to scrape or wash off.

The *Brazilian yam*, another white variety is my preference for forage. It is not so early perhaps as one or two other varieties; but it produces immense crops of vines and tubers, a good proportion of the latter rounded, and containing a very large quantity of nutritious material. They grow very large too, ranging from one to fifteen pounds in weight. Sometimes one is found that cannot be put into a peck measure. The *Southern Queen* is perhaps as valuable as the preceding.

Soil. The sweet yam attains greatest perfection on a rather poor sandy clay soil. The Spanish requires a similar soil but richer. The other varieties named above require still richer soils with less sand. The more sod, straw and weeds turned into the bed and covered the better provided there be earth enough to enable the plants to take root. The crop must be kept free from grass and weeds. No crop is more seriously damaged by grass than the sweet potato. They require a large, loose, deep bed, and a little earthing up about once. I greatly prefer a high flat bed to the sharp ridge or conical hill. With the flat bed the cultivation can be managed mostly with the plow, and the plants suffer less from drought, than in the sharp topped ridge.

Whatever mode be adopted, there is a tendency in the vines to strike root at every joint, especially if there be frequent falls of rain. These roots form tubers and diminish the size and quantity of those in the bed. Hence it is well, when this occurs to lift the vines from the ground so as to destroy these secondary roots.

Harvesting After removing the vines as above described or otherwise, the bed may be opened with the digger, or with any large turning plow, hands following to pick up and pile the potatoes turned out at each passage of the plow. After all visible are thus removed a heavy harrow may then be run over the

ground, which will bring many bushels more to the light. But still many will be left for cows, sheep, hogs, mules and horses to glean after a rain.

Time to harvest. I would prefer, if I had the making of the seasons, to dig a day or two after a light frost to scorch the leaves and check growth. As to wet or dry condition of the ground, I find little difference as to the keeping of the tubers. I have felt obliged to harvest when the tubers were covered with mud, sometimes the potatoes much smaller than the mass of adhering mud. They have kept perfectly sound through the entire year. It is more pleasant and rapid work to harvest when the ground is dry enough to crumble freely, but I have not found the tubers keep any better than when put away wet. A cold rain on them while harvesting is damaging.

But there is one infallible rule I think as to the time to harvest. Break or cut a few tubers; if the raw surface dries and scabs over promptly, and the air is not too cold, the crop may be harvested at once without reference to any other indications. It will be hard to make the tubers rot. But if the raw surfaces do not so dry, many will rot no matter what course and methods may be adopted to prevent it. The later the harvesting can safely be delayed the better as some varieties grow most rapidly in the cool autumn when the nights are chilly.

Seed and planting. My rule is never to plant the small, refuse potatoes. This soon runs down the valuable tuber. I select my roots for planting while harvesting, reserving for that purpose the largest, smoothest, most perfect tubers, and as nearly globular as possible. In February I make a hot bed, in which I place these potatoes close together, but not touching. The bed may be a yard wide and long enough to produce as many plants as may be desired. If the tubers are very large, I split through the middle and place the cut surface downward. As soon as the plants are large enough in April, they should be drawn and set out, the beds being at least four feet from middle to middle, and the plants along the middle eighteen to twenty-four inches apart. Frequent drawings should be made. It is not necessary to wait for rain, "seasons." Make a grout by mixing in a hole in the ground recent cow dung and clay with water, dip the lower part of the plant in it, set out, pack earth firmly at bottom of root without bruising, pour in a little water, then cover the damp surface with earth loosely and your plant will grow.

Cut vines also grow very readily managed in the same way. Whether cut vines or plants, I prefer to have not more than two eyes or leaves above ground. Either grows best by being put in the ground slanting. It consumes time and makes some work to cut off all the leaves from the part to be put in the ground; but I prefer to do it, because the earth can be so much more nicely

fitted around the plant or cutting. The leaves if buried rot off, leaving openings through which the plant dries up. The cut vines yield abundantly; but I think plants make more round tubers. One accustomed to use his eyes for seeing, can distinguish at a glance as far as he can see distinctly, a pile of potatoes grown from plants, from another pile grown from cuttings of the small, refuse tubers generally saved for planting; the former being nearer round, smoother, more symmetrical, larger, better every way. And there is about as much difference in quality as in appearance.

Product. I think 200 bushels not a large crop per acre, and 400 not difficult to attain. Yet how many planters never get 100 bushels per acre? The most successful potato grower I ever knew thought 700 bushels per acre not a very extraordinary yield. The crop is easily made, the yield very large and may be fed or sold with immense profit. Yet how little attention does it receive on the cotton plantation of to-day!

Saving. Drive, barely deep enough in the ground to hold, three boards so as to form a sort of rough tube, pile the potatoes around heaping up to a cone, cover with grass, corn stalks, or leaves, (pine straw is most convenient in some respects,) then with boards and the last with earth from six to twelve inches in thickness, according to latitude, leaving the ventilator open, and lastly a little above the top of all fix a cap to exclude rain.

Another way is to arrange several such ventilators as described above, or any other shape, a few feet apart in a row, heap the potatoes along so as to form a long rick and cover as above directed. Use from one end.

Another way. Put in the ground three or four feet deep four posts eight or ten inches thick and projecting as high as desired above the ground, so arranged as to form the corners of a house. Pin or spike on to these posts thick planks or slabs inside and out, and fill in between with earth; cover with strong joists, floor and earth on that; put on a roof and the house is completed and ready to receive potatoes. In this and the long rick the entrance should be at the south end; and the earthen covering should be very thick at the north end. In very cold weather some straw or hay may be thrown over the top of the potatoes. I have been equally successful with each of these methods, having never lost potatoes but two seasons when not able to give my personal attention to the storing.

I have given much space to this subject; but it is because its importance demands it. We in the southern States can grow no cheaper or more profitable crop than the sweet potato.

CHAPTER VI.

The Night Shade Family.

While this family affords many poisons and valuable medicines and a few nice vegetables and condiments, as red pepper, egg plant and tomato; it gives but one of much value as food, the Irish Potato.

SOLANUM.

S. TUBEROSUM. The potato is too well known to need description and its value as food for man is every where recognized. It is valuable also as food for live stock. But as it should always be cooked for them, is more expensive to grow, less relished and less profitable than the sweet potato and less certain as a crop, I can not recommend it as a food crop for live stock.

CHAPTER VII.

Nettle, Buckwheat and Pine-Apple Families.

1, The *Nettle Family* includes the Elms, Figs, Mulberries, Osage Orange, Hemps and Hops; but no forage plant perhaps properly so called, although cattle eat with relish the foliage of some plants of this order. The leaves of the mulberry are quite nutritious. The *Bœhmeria* seems to be worthy of some attention as a forage plant. We have but one native representative of this genus; but it is everywhere regarded as a nuisance.

The *B. nivea*, (formerly *Urtica nivea*) better known in America by its Malayan name of *Ramie*, was introduced into many parts of the south some years ago as a fibre producing plant. It produces a most beautiful, strong fibre, of a transparent, glossy whiteness surpassing the finest specimens of linen. I have seen nothing in textiles more beautiful than handkerchiefs and shirts made of Ramie fibre of American growth. It is from this that the famous Chinese grass cloth is made. It is said to be superior to all other materials for Brussels lace.

This plant grows readily from seed and from root-cuttings and may be rapidly multiplied. It may be cut three times a year, yielding an immense qnantity of fibre. It requires little cultivation after once fairly started to grow. But being a new thing requiring a new mode of industry and speeial machinery for prepariag it for market, it has nearly disappeared from our country.

It yields in its broad leaves an immense quantity of foliage much relished by cattle; and a few persons who could not otherwise utilize it, fed to their cows. I have no doubt it is very valuable as a forage plant and deserves special study as to its nutritive qualities. It is easily mowed with a machine.

2. Of the *Buckwheat family*, we have several native and exotic genera and many species; mostly noxious weeds, some ornamental and but few useful. The docks are pests as also some of the smart weeds; though some of the latter are eaten by sheep. Of *Fagopyrum*, Buckwheat there are two cultivated species and several varieties. It is commended much as forage in some countries. Three crops a year may be grown in the southern States. The seeds are good for poultry and pigs and when well cleaned, ground and prepared for the table, by many people much relished as Buckwheat cakes. I have planted Backwheat several years at intervals. But as a forage crop, or for plowing under as a fertilizer, I think we have many other plants much more profitable for the use of the southern farmer.

3. Of the *Pine-Apple family*, we have but one plant to mention in this connection. *Tillandsia usneoides*, Black moss, Spanish moss, long moss is an air plant found growing luxuriantly on trees in large districts in many southern States. The fleshy leaves and epidermis contain considerable sugar and other nutritious matters, and are used in some countries in times of scarcity of other food for cattle. Some horses also are fond of it. The uses of the long, black, tough, fibrous central thread in various manufactures are well known every where.

CHAPTER VIII.

The Sedge Family.

This family is represented in the southern States by over 20 genera and about 250 species, mostly worthless, a few great pests, and a few useful. They are rush-like, or grass-like plants with the solid stems mostly 3 angled, the grass-like leaves when present commonly three ranked, the sheath a closed tube, and the involucre at the top of the stem consisting of grass-like leaves, often very long. These plants contain little nutritious matter and are not much relished by cattle. When hungry, however, they may eat bog or swale hay, which is made up largely of the sedges.

1. CYPERUS REPENS, the common grass nut is generally known and sometimes cultivated for its sweet little nut-like tubers, much relished by all live stock, children and older people. They are sometimes found in the markets.

2. C. ESCULENTUS, the chufa from Europe is much like the preceding in flavor, not quite so sugary, tubers more flattened and elongated. Both are very nutritious, the latter more prolific, yielding a large amount of excellent food, especially for pigs and poultry. It is propagated from the tubers, planted singly in a loose soil ten or fifteen inches apart in rows two feet apart. Both kinds are planted alike. The Chufa produces its tubers just under the surface of the ground and they are easily found by pigs and poultry. These animals having free access to them will exterminate them in a single season. The grass nut burrows a little deeper and is not so easy to destroy; yet it is not troublesome.

3. C. PHYMATODES and 4. C. ROTUNDUS, (variety *Hydra*) Nut-grass, Coco-grass are fearful pests, very difficult to eradicate and causing many a fine farm and garden to be abandoned. Hogs are fond of the bitter, rank-odored tubers and by rooting for them damage lands seriously. The under ground stems and fibrous roots are literally woven together in such a dense, strong fabric as to render plowing tough work and hoeing very uncomfortable. The plants improve tenaceous clay lands and prevent washing. I would advise, however, to suffer not one to grow any where. They multiply with astonishing rapidity. On clay lands infested by them good corn crops may be made and still better cotton crops. It requires more hard work than on other lands. But after one good plowing and careful hoeing of the crop, they give very little further trouble for the season. In most other crops they are utterly intolerable.

Like quack grass, these plants grow through Irish potatoes; and not unfrequently tubers are found within potatoes. If an eye happens to stop within a potato, it seems to develop a tuber there as readily as any where else.

Many experiments and attempts have been made to destroy these Cocos. If the place occupied be small, shaving daily the surface of the ground so as to remove the preceding twenty-four hours' growth of leaf will in course of time exhaust the tubers and thus destroy the plants. For they can make no new tubers if prevented from leaf-making. On larger spaces, by obtaining early in spring a dense growth of vines of our common field pea, I have so far destroyed it as to have little trouble with it for two or three succeeding years.

I have tried other experiments with it, such as watering it with crude carbolic acid of full strength, without any apparent injury to the plant. The most satisfactory results I have had were obtained by sowing, on ground as thickly set with it as possible, red clover seed. When a full stand was not obtained at once on any part I reseeded till it was covered. In two or three years not a sprig of coco could be found; while all the time I was having fine clover crops, worth more probably than any

other crop that could have been grown on the same land even though free from the Coco.

CLADIUM EFFUSUM is the Saw grass of marshy places, with its saw-edged leaves working fearful damage to clothes and skin of those coming in contact with it.

The principal use of the *Carex stricta*, or tussock grass is as a footing to persons crossing boggy lands.

CHAPTER IX.

The Grass Family.

The first and oldest fiat ever uttered calling into existence any organized being of which we have any knowledge or record went forth as soon as the land was born from the watery womb of the Abyss; and it runs thus: "*Let the Earth bring forth grass.*" —Gen., I, 11. Promptly Earth donned her emerald robe. Geology confirms the record that grasses were among the earliest organized things of our terraqueous globe. And this must needs be so, since it is written "bread is the staff of life" and declared that "All flesh is grass." The greatest earthly blessings conferred on men and animals are derived from a luxuriant growth of grasses; the greatest distresses and curses, from their absence or destruction.

This very large family or Order furnishes a greater number of useful plants than any other. And they are in many respects more valuable and more essential to the support of animal life than all others together. Besides fibres for cordage and textiles of many kinds, coal and other fuels, many other materials useful in many arts, sugars and syrups, they supply the bulk of foods for man and beast.

As illustrating the value of this family, it may be stated that the value of the annual products of grasses in the United States is several times greater than that of the cotton crop of the whole world. Even the hay crop of the United States is worth more than the entire cotton crop of the whole world.

The farmer, therefore, has a deeper, more abiding interest in this order of plants than in all others. For what would be the condition of man without maize, wheat, barley, oats, rye, rice and sugar cane? What of animals without other grasses? Yet only a few of the thousands of species can be mentioned here.

LEERSIA.

1. L. ORYZOIDES. White Grass, Cut Grass, False Rice. This beautiful native grass is found in wet, swampy places, and along the margins of ditches and streams. The stems grow

from two to four feet high, commonly prostrate at the base. The leaves are long and narrow, and the sheaths very rough and sharp to the hand drawn downward in contact with them.

2. L. VIRGINICA. Small flowered White Grass, Virginia Cut Grass. This grass also is beautiful, more delicate and smoother than the preceding. It grows in the same localities as the other. Both have been cut for hay, of which it is claimed by some, they make an excellent quality. As they often grow in soft mud and shallow water, they must be moved to dry land as soon as cut in order to dry them. They are not of sufficient value to induce any one to grow them; but yet where growing spontaneously, they may be mowed with profit.

3. L. HEXANDRA. This species, with slender stems from one to six feet long and narrow rigid leaves, would be of little value if it could be mowed. But as it grows in lakes and ponds even though water be pretty deep, this is impracticable.

4. L. LENTICULARIS. Catch Fly Grass. This species having much the same habit as the preceding is of as little value. It is chiefly interesting because Pursh says that he has observed it catching flies with its pales, which in structure resemble the leaves of the Venus' fly-trap.

Zizania.

1. Z. AQUATICA, Wild Rice, Indian Rice, Water Oats. This grass abounds in marshes, ponds, shallow streams and on some of the floating islands or shaking prairies. The broad leaves are rough underneath and the stems from four to ten feet high, bearing a widely spreading pyramidal panicle one or two feet long, the long lower branches of which bear the staminate blooms, the upper erect branches bear the pistilate or fertile flowers. The cylindrical seeds, half an inch long, when ripe fall by a slight motion of the stems, and furnish a large quantity of food for birds and other animals. The Indians often harvest the seed for their own food, as other races may have done in some cases, this being the *folle avoine* of the early French settlers of the Mississippi valley. When the anthers burst, the grains of pollen, being lighter than the atmosphere, float up to the stigmas; just the reverse of what occurs in our Indian corn. This grass is relished by stock, may be cut twice a season, and yields a large quantity of good hay. It must be cut before maturity to obtain the best results.

2. Z. MILIACEA, Prolific Rice, grows in the same localities

as the preceding, nearly as tall; panicles with staminate and pistilate spikelets intermixed; leaves somewhat glaucous, smooth, with rough edges; grain oval, and in great abundance. It may be used in all respects as the preceding. When the spring and summer prove dry, many of our shallow lakes dry up, leaving these and other water grasses growing luxuriantly. Planters for miles around mow and utilize these gratuitous harvests.

ORYZA.

O. SATIVA, Rice, from Asia, but now cultivated in many parts of both hemispheres of our globe forms the principal article of food to more millions of the human race probably than any other grain. In our southern States, we have several varieties of rice, known as white and red; awned and beardless; upland and lowland. The larger quantity is produced on lands that may be flooded and thus kept clear of most weeds, and the expense of cultivation reduced to a minimum. But on the other hand, small areas for home consumption and as an auxilliary crop are cultivated over a very large portion of the southern United States in highland rice. The large grained beardless white is the variety usually preferred for uplands. To render cultivation easy, many farmers annually clear a "new ground" for the rice crop, as by this means the plants are less beset with grasses and weeds and the cultivation is lighter work. It is only as food for live stock (cattle especially) that it is here noticed. The seeds mature while the stems and leaves are still quite green. These last when properly cured constitute a valuable hay. The upland rice planted on new land in April matures a crop of large-sized grain of the best quality and a large quantity of hay. If the season be favorable, a second crop from the same roots of smaller growth and smaller grain may be mowed in October for hay. Both, usually thrown away, are very valuable and should be carefully utilized.

ALOPECURUS.

1. A. GENICULATUS, Floating Fox-tail Grass. The culms of this grass are from 6 to 12, rarely 18 inches long, bearing compressed cylindrical spikes from 1 to 1½ inches long, bent, geniculate at the lower joints; leaves 3 or 4 inches long, the sheath of the upper one about as long as its leaf, which distinguishes it from meadow fox-tail in which the upper sheath is more than twice the length of its leaf. It blooms from February till May, growing in damp cultivated grounds and meadows, ditches, ponds and sluggish streams. It is of little worth.

2. A. PRATENSIS, Meadow Fox-tail, is larger than the preceding, 2 to 3 feet high, grows with great luxuriance, and in England is regarded as holding a place with the best grasses, both as green forage and as hay.

Way's Analysis.	Green.	Dried.
Water,	80.20	——
Albuminous or flesh forming principles,	2.44	13.32
Fatty matters,	.52	2.92
Heat producing principles, starch, sugar, etc.,	8.59	43.12
Woody fibre,	6.70	33.83
Mineral matter or ash,	1.55	7.81
	100.00	100.00

This grass resembles timothy in appearance, but the head is soft, while that of timothy is rough. It grows after cutting much more rapidly than timothy and bears grazing better, though it does not attain perfection till two or three years old. It grows best on rich, moist or even wet soils and is one of the most valuable of grasses.

Phleum.

P. PRATENSE, Timothy.

About one hundred and seventy years ago, a Mr. Herd found this grass in a swamp in New Hampshire. He cultivated it; others followed his example and called it Herd's grass, by which name it is still know in New York and the New England States. It must be noted, however, that this is not the herd's grass of the other States. From the shape of the spike it is often called Cat's-tail grass. About the year 1720, it was brought to Maryland by Timothy Hanson, who cultivated it so successfully on the Hanson farm as to give it a widespread fame and the familiar name now generally accepted for it.

Loudon claims it as a native of England. The Am. Farmer's Cyclopedia says it is "perennial, native of Britain," and in the next sentence but one says, "This is a great *American* grass, and is called timothy from Mr. Timothy Hanson, who first introduced its seeds into Maryland." It may have become naturalized in America at a very early time; but from a large amount of testimony, with which these pages need not be encumbered, there is strong reason to believe that it is a native of the United States, and was taken from Virginia to England about the year 1760. It attracted but little attention in England till 1824, when Sinclair's Woburn Abbey experiments were made.

The more elaborately accurate investigations of Prof. Way fully established its value. Subjoined is

PROF. WAY'S ANALYSIS.

	Green.	Dry.
Water,	57.21	——
Albuminoids,	4.86	11.36
Fatty matters,	1.50	3.55
Heat producing principles,	22.85	53.35
Woody fibre,	11.32	26.46
Ash,	2.26	5.28
	100.00	100.00

These experiments and analyses have no doubt contributed largely to the extended culture of timothy as a hay grass. This grass being easily handled, the hay having a fine appearance and subject to little waste in transportation also serve to render it a favorite for marketing. Analyses showing further that this grass cut when the seeds are fully ripe contains twice as much nutriment as when cut in bloom, this fact also serves to render it more generally popular. But this very fact, while perhaps fully comprehended by the shrewd farmer, is liable to mislead the purchaser. The increased nutriment is accumulated in the ripe seeds. These the farmer threshes out, ships the hard, woody stems, and sells the seeds to other farmers for more than his hay brings him. Or if he use such hay at home, it is so difficult to digest that it taxes the powers of the animal and then a large portion of the nutritive matter is lost from the inability of the assimilative organs to appropriate it.

Timothy is a very destuctive crop in one sense; it exhausts and impoverishes the soil very rapidly unless heavily manured. Its roots penetrate to little depth, and in two or three years it exhausts the soil near the surface. This may be obviated to a certain degree by growing red clover with it. But this is an unsatisfactory arrangement because the clover is ready to mow long before the timothy. If mowed when the clover is ready, the loss in timothy will be great; if mowed when the timothy is ready the loss of clover will be greater.

Yet it makes a very superior hay and if heavily manured, not kept too long on the same land, and specially if fed on the farm and the manure therefrom returned to the soil, no great loss or damage will be incurred. I do not regard it, however, as the best or most desirable hay grass for the south. On dry upland the roots become bulbous, it bears drought and grazing badly and should be cut early to obtain the best advantages from it. It succeeds best on moist bottom land, but does not bear grazing very well in any situation in the south. But it will give as heavy mowings in the southern States as any where. I have, however, ceased to grow it, although on good land it will yield four tons per acre. But this quantity of timothy hay removes from the soil *six hundred pounds* or more of potash per acre.

It should be sown on well prepared land in September or October, February or March, at the rate of twelve to fifteen pounds of seed per acre, and harrowed.

In the eastern States it has been more and more damaged each succeeding year by an insect killing the stems, and the same may occur in the south.

It should have been stated that in mowing, timothy should be cut above the second joint as it then recovers more promdtly than when cut close to the ground.

Sporobolus.

S. indicus, Smut grass.

This perennial plant from India is thoroughly naturalized and at home in our southern States. In some localities it is known as 'carpet grass.' But we have several other carpet grasses. After blooming a large proportion of the panicles become affected with a dark parasitic growth, which adheres to the clothing of any one coming in contact with it, giving it a smutty appearance; and hence it is appropriately and more generally termed smut grass.

It grows abundantly and luxuriantly on many uncultivated fields and commons, and furnishes grazing from April till frost. It thrives under much grazing and many mowings, and grows promptly after each if the soil be moist enough. Cattle and horses are fond of it, if frequently cut or grazed down. But if allowed to remain untouched long, they will not eat it, unless very hungry as it becomes tough and unpalatable and probably difficult to digest. It grows in clumps producing many long leaves one to three feet, and culms, the latter generally eighteen inches to two feet high, though on rich land sometimes three feet. July 27, I have just measured some 4 feet 8 inches. The long, (6 to 18 inches) slender, compact panicles usually appear like spikes unless closely examined.

Like other grasses, especially Bermuda, Johnson and gama grass, it must be cut early and often to make good hay. But under the most favorable circumstances it does not make a very choice hay, although containing a large quantity of nutritive principles as shown by Mr. Collier's analysis, which is here given:

Proximate analysis of Sporobolus Indicus from Mississippi.

Oil,	2.99	Anylaceons cellulose	27.06
Wax,	.31	Alkali extract,	14.16
Sugars,	8.17	Albuminoids,	12.46
Gum and dextrin,	2.75	Ash,	6.19
Cellulose,	25.91		100.00

ANALYSIS OF ASH.

Potassium,	12.16	Sulphuric acid,	4.60
Potassium oxide,	33.53	Phosphoric acid,	6.02
Sodium,	——	Silicic acid,	27.36
Sodium oxide,	——	Chlorine,	11.03
Calcium oxide,	2.64		
Magnesium oxide,	2.66		100.00

Its generic name is founded on the fact that it sheds its seeds so easily; and hence it has been called also Indian drop-seeds.

Of several other species found in the southern States, none need special mention.

MUHLENBERGIA.

M. DIFFUSA, Wire Grass, Nimble Will, Drop-seed Grass. This and Bermuda grass are often mistaken for each other. But the stems of this are not so much covered by the sheaths as in the Bermuda; the leaves are shorter and broader in proportion to length, rougher and lighter tinted than in Bermuda; it has but one leaf to each node and joint, while Bermuda has two or three and even four; and the culms of the latter are crowned with usually three to five digitate spikes, while the former has an appressed rather long panicle. Both are perennial. Wire grass affects the open woodlands; Bermuda, open sun-exposed fields. Bu- the latter is often found in open woodlands also; and sometimes we see its possession of the open field contested by the former with pretty equal suceess for years. The wire grass is more wiry, grows taller and is less nutritious, less digestible and l ess relished by stock than the Bermuda.

Yet it has a very good percentage of nutritive matter as shown by Mr. Collier's

ANALYSIS OF MUHLENBERGIA DIFFUSA.

Oil,	1.39	Amylaceous cellulose,	19.81
Wax,	.43	Alkali extract,	23.89
Sugars,	8.96	Albuminoids,	10.06
Gum and dextrin,	4.48	Ash,	7.61
Cellulose,	23.37		
			100.00

Analysis of ash.

Potassium,	6.78	Snlphuric acid,	3.39
Potassium oxide,	17.32	Phosphoric acid,	6.65
Sodium,	1.33	Silicic acid,	39.98
Sodium oxide,	——	Chlorine,	8.21
Calcium oxide,	11.95		——
Magnesium oxide,	4.39		100.00

The analysis shows that those who esteem it as a butter producing grass have good reasons for their faith. Some think it also imparts a specially agreeable flavor to butter. Some say their stock are fond of it and that feeding on it in 'the range' they become sleek and fat. My own horses, mules, cows and hogs have never seemed to like it; and although sheep eat it readily and profitably, I am obliged to confess I regard it on one piece of land at least as one of the worst pests I have ever had. I have mowed it from two to four feet long and made pretty good hay of it; and it is easily cured. But it is difficult to control and exterminate; and I would prefer not to have it on my lands, occupying the place of better kinds.

Another species, *M. Mexicana*, is very similar in all respects. A large area must be mowed and a huge bulk of these grasses accumulated to obtain a considerable weight of hay.

The several other species are of too little agricultural value to merit special notice.

Calamagrostis.

C. canadensis, Blue Joint Grass, grows in bogs, reclaimed marshes and moist meadows in many parts of the eastern, northern States and about lake Superior. The culms are from 3 to 5 feet high. On soil suited to it, its growth is rank and luxuriant and it yields an immense quantity of hay. It is greedily eaten by stock. I am not aware that this grass has ever been tried on any of the bogs or wet lands of the south. Our southern species, *C. coarcatata*, or glaucous small reed grass is rare, grows in swamps and has attracted no attention, The *C. arenaria*, beach grass, mat grass, sea-sand reeds grass, of no agricultural interest directly, is yet very valuable in many parts of the world, doing what King Canute could not. Only two or three feet high, its roots 20 to 30 feet long, are full of tubers, strong, and bind the sands and hold them against the action of winds and waves and thus prevent the encroachment of the seas. It has been the subject of much legislation, municipal, State and national, on both sides of the Atlantic ocean; and much property has been saved by a judicious planting of this grass, in the eastern States.

SPARTINA. Marsh Grass.

In the south are four species growing in brackish marshes. These, especially *S. polystachia* with culms 4 to 9 feet high and leaves ½ to 1½ inches wide, furnish in spring and summer a large quantity of green forage, esteemed very valuable. But they can be grown only on limited areas and are of so doubtful utility that more special notice is not demanded.

AGROSTIS.

1. A. VULGARIS, Red Top Grass. This is the bent grass of England, the herd grass of the southern States; not in honor of any man, but probably because so well adapted to the herd. It is called also fine top, Burden's and Borden's grass. Varying greatly in characters according to soil, location, climate and culture, some botanists have styled it *A. polymorpha.* It grows two to three feet high and I have mown it when four feet high. It grows well on hill tops and sides, in ditches, gullies and marshes; but delights in moist bottom land. It is not injured by overflows though somewhat prolonged. In marshy land, it produces a very dense, strong net work of roots capable of sustaining the weight of men and animals walking over it.

It furnishes considerable grazing during warm 'spells' in winter, and in spring and summer an abundant supply of nutrition. It has a tendency, being very hardy, to increaee in density of growth and extent of surface, and will continue indefinitely, though easily subdued by the plow.

Cut before maturing seed, it makes a good hay and large quantity. It seems to grow taller in the sonthern States, than it does further north, and to make more and better hay and grazing. It and timothy being adapted to the same soils and maturing at the same time do well together and produce an excellent hay. But the red top will finally root out the timothy—if pastured much it will do so sooner.

Sow about two bushels (24 lbs.) per acre, if alone, in September, October, February or March; if with timothy for hay, from 6 to 10 pounds; if with other grasses for pasture, 3 to 5 pounds. It is an excellent pasture grass, and will grow on almost any kind of soil.

2. A. ALBA. White top, dew grass, bonnet grass, has become naturalized in some of our southern swamps. In similar localities we have also 3. *A. perennans* and 4. *A. elata,* (A. dispar, Mich.) The latter or southern bent grass, is stouter, has broader leaves, and more numerous creeping roots and furnishes more grazing and hay but coarser than the true red top. It deserves the attention of those having lands adapted to it. On sterile lands now and then may be seen 5. *A. scabra,* hair grass, tickle

grass, more curious than valuable. Its large, loose, delicate panicles when dry, break off and sail away on the wind. It is hence called fly-away grass.

6. A. STOLONIFERA, var. LATIFOLIA, larged leaved creeping bent grass, or Fiorin, Faureen of Ireland, has attracted much attention in that country as yielding large crops of hay, from four to seven tons per acre. Those who have marshes otherwise useless, would probably find their profit in introducing this grass.

CYNODON.

C. DACTYLON. Bermuda Grass. This plant is called also scutch grass, dog's tooth grass, (a literal translation of *Cynodon,*) wire grass. Messrs. Darlington and Thurber quote Sir James Edward Smith, the botanical editor of Rees' Cyclopedia, as saying, in the article PANICUM *dactylon,* that "This grass was perceived by Mr. Lambert to be no other than the Agrostis linearis of Kœnig, Retzius and Willdenow,—the Durva of the Hindoos, —which the late Sir William Jones, in the fourth volume of the Asiatic Researches, has celebrated for the extraordinary beauty of its flowers, and its sweetness and nutritious quality as pasture for cattle." This points to Hindostan as the native land of Bermuda grass. Yet Loudon, on the authority of the English Botanist in 36 volumes by this same Sir James Edward Smith and James Sowerby, claims that it is a native of England. Here seems to be a clash between Smith's Cyclopedia article and his Botany. Loudon's description is clearly that of Bermuda grass, or as he has it, *Cynodon dactylon.* In the next line he gives Cynodon linearis, as native of the East Indies and introduced into England in 1796. His description of this plant does not at all suit Bermuda grass. He says further, Cynodon linearis, the Agrostis linearis of Kœnig, is the famous *durva* grass of the Hindoos, for which, see Lambert in the Linn. trans. VII, No. 22.

In the Department of Agriculture, Report for 1878, Messrs. Geo. Vasey, Botanist, and Peter Collier, Chemist, state that "This grass is a native of Europe, and is abundantly naturalized in many other countries. It is said to be a common pasture grass in the West Indies." Hence I think it clearly evident that Bermuda grass is neither the sacred Durva of the Hindoos, nor a native of Hindostan, nor what Mr. Howard in his pamphlet calls "the celebrated Daub sacred grass of India." It seems evident to me that Smith in the Cyclopedia article inadvertently substituted the *C. linearis* for *C. dactylon,* and hence all the errors about it since the publication of Rees' Cyclopedia. Since the above was written, I read in the American Agriculturist for 1880, page 64, "Bermuda grass, or Scutch grass in our southern

States, Creeping Dog's-tooth grass in England, Chiendent in France, and Doob or Durva in the East Indies, are different common names for the grass called by botanists *Cynodon dactylon*."

This writer continues :—"In one respect it is the most remarkable grass within our knowledge, as one can with equal ease find that it is the most valuable of all the grasses, and one that is to restore worn-out southern fields, and bring untold blessings wherever introduced, or that on the other hand that it is a curse to the soil, and that when this once gets a footing upon a farm, the owner may as well give it up at once, as to do so at the end of a struggle in which he is sure to be worsted." One side or the other may be true as one's stand point may be different from that of another. If without previous preparation of the land, one breaks it up while well set with this grass and plants his crop, he will find it indeed an unmitigated curse in the management of his crop. If on the other hand he needs it as a pasture and hay grass and renovator of the soil he will pronounce it as nearly as can be an unmixed blessing.

Sixty years ago Mr. Elliott said very justly, of this grass, it is "tender, delicate, growing over and binding the most arid and loose sands in our country, and apparently preferred by stock of all descriptions to every other grass." The last portion of this statement has been verified annually for the last thirty years on a common three miles west of Woodville, Mississippi, hundreds of animals feeding there on this grass summer and winter. This is true also of localities on the St. Catharine bottoms near Natchez and hundreds of other places.

Mr. Elliott adds "The cultivation of this grass on the poor and extensive sand hills of our middle country would probably convert them into sheep walks of great value ; but it grows in every soil, and no grass in close, rich land is more formidable to the cultivator ; it must therefore be introduced with caution." Thousands can confirm this statement also. Yet I know farmers who take pains to introduce and retain it on their cultivated, 'close, rich lands.' But they keep it under sufficient subjection to interfere but little with cultivation ; and they think that by preventing the land from washing and improving it otherwise, this grass more than pays for the little additional expense of culture. But a poor manager or indolent planter would do well to keep it out of his cultivated fields.

As a permanent pasture grass, I know no other that I consider so valuable as this, after having transplanted it from near the mouth of Red River to my present residence thirty-five years ago and having studied it on hundreds of other farms, commons and levees for a longer period. Under the head of Blue grass I give in a table the comparative quantities of nutritive matter of the two grasses, the analysis showing the Bermu-

da to contain more than the Blue grass. Here is in more detail, Mr. Collier's proximate analysis of Cynodon dactylon:

	From Georgia.	From Alabama.
Oil,	1.86	1.23
Wax,	.36	.36
Sugars,	6.56	8.17
Gum and dextrin,	9.29	3.59
Cellulose,	24.55	23.57
Amylaceous cellulose,	27.43	29.30
Alkali extracts,	12.64	12.23
Albuminoids,	11.15	13.59
Ash,	6.16	7.96
	100.00	100.00

Analysis of ash.

	From Georgia.	From Alabama.
Potassium,	6.66	9.61
Potassium oxide,	22.99	22.89
Sodium,	——	.42
Sodium oxide,	——	——
Calcium oxide,	13.44	7.99
Magnesium oxide,	5.00	2.96
Sulphuric acid,	9.37	11.31
Phosphoric acid,	6.20	5.09
Silicic acid,	30.29	30.27
Chlorine,	6.05	9.46
	100.00	100.00

As hay this grass has been cured and held in high esteem by many farmers in Mississippi for more than forty years. The late Mr. Thomas Affleck of Texas, but for many years a well known planter of Mississippi, with characteristic Scotch thrift promptly recognized the value of this grass, largely profited by it, and, as long as he lived, by mouth and pen inculcated its great worth for pasture and hay, himself making five tons per acre of the latter. Dr, Ravenel by the aid of nitrate of soda obtained at the rate of ten tons per acre on a lot near Charleston, S. C. Many other examples could be given as to the quantity of hay cut from this grass and innumerable testimonials as to its nutritive value. Having grown this grass only on worn hill lands without fertilizers my crops have of course not been so heavy as those mentioned; but they have been entirely satis-

factory. On good soil it covers the ground densely several inches deep with its prostrate stems and dense leafage which is always moist even in dry weather.

It does not bear dense shade, and when grown in shade is, like other plants, much less nutritious. It grows best where most exposed to the intensest heat of the sun. It bears drought better perhaps than any other of our grasses. But its underground roots or stems being near the surface and hogs being very fond of them in dry weather, at such times, if these animals are confined to small lots of this grass, they eat every root and thus exterminate the grass. I have seen this occur more than once to my own serious detriment.

As a fertilizer it is one of the best. Being always moist and, where the growlh is vigorous, studded with dew drops underneath throughout the dryest, hottest days; air enmeshed in large quantity, as in the packings for ice, in its densely tangled and packed masses seems to keep the carpeted earth cool and moist in hot weather and warm in cold weather. Hence the continuous, ceaseless absorption, condensation and storage of plant food from the atmosphere in the roots, and subjacent soil. Nor is this all; perhaps not its most important influence in fertilizing the soil. At any rate a more remote or secondary effect, though so far as I am aware wholly ignored, is of no little importance in arriving at its value as a fertilizer. It is well known that earth worms have the power under certain conditions of improving and elevating the soil, and even making soil where there is none, by elaborating materials from the subsoil and atmosphere and depositing on the surface the manufactured fertilizer. I have often looked with wonder and admiration at the vast amount of this kind of beneficent work performed by these little creatures in a single night.

A piece of ground well coated with this grass is the paradise of these worms—rather the cheerful laboratory of these industrious little manufacturers of fertilizers. Many may be surprised to learn that here on any pleasant night and often day, the sounds emanating from the industrial works of these pigmies may be distinctly heard. With all their might, little individally it is true, but in the combination of vast numbers *mighty*, they are constructing soil for the intelligent farmer.

Nor is this all; their bodies are made up very largely of albuminoids,—the best plant food,—and these as the successive generations die are added to the soil. I will not stop to mention other benefits bestowed on the soil by other kinds of labor of this industrial hive. But I must not omit another good growing out of the presence of these worms.

Such a Bermuda grass meadow as that described is in summer a paradise for pigs too,—not merely for the grass, the value of which all recognize, and which the pigs enjoy, but the benefit

and enjoyment are doubled by the animal food so much craved by hogs and furnished by these worms in ample supply. The pigs literally revel among the tender grass and tender luscious worms as the human animal delights in his green peas, mutton and fat oysters in March and April.

Treating this grass from an agricultural stand point I need only mention its utility in binding together and holding levees of sand and loose soil against floods of water, its preventing lands from washing and its filling gullies, in all which its value is inestimable.

Mr. Howard in his manual gives the views of Col. Lane, who states that thirty years before, he had purchased an old plantation cheap because infested in places with this grass. He permitted a man to occupy thirty acres of it five or six years. The man had a cow and calf, sow and pigs, and a brood mare. He cultivated a little corn never making enough to feed his family. For the *increase* of live stock in this short time grown on this grass almost wholly, Col. L. offered him $1,000. To show the value of this grass as a fertilizer, Col. L., after the man left, cultivated this thirty acres of land. "The first crop, cotton, half stand, owing to the mass of undecomposed sod, eighteen hundred pounds of seed cotton per acre. Second crop, cotton, two thousand eight hundred pounds seed cotton per acre. Third crop, corn, sixty-five bushels per acre—corn manured with cotton seed. Fourth crop, wheat, forty-two bushels per acre. The average product of this land without the sod, would have been not more than one hundred pounds of seed cotton, fifteen to twenty bushels of corn, and eight to ten of wheat. I know of no crop that will improve land more, and certainly none that will, at the same time, give so large an income with so little labor."

Mr. Howard gives equally strong testimony from others. And I have seen commons set with this grass, on which hundreds of cattle, horses, hogs, sheep and goats were running constantly the year round, mowed year after year and the hay sold for two to four times as much as any cultivated crops produced at five times the cost in the vicinity on similar land could be sold for.

But this grass has its disadvantages too and sometimes no doubt kills pigs and possibly other young animals. If not frequently grazed or mowed during summer, the stems become hard, wiry, and full of indigestible woody fibre in the fall.. This sometimes becomes impacted in the bowels of young animals and thus kills them. To make good pasture it must be kept well trodden and grazed to keep it tender, digestible and nutritious and to suppress other objectionable grasses and weeds; otherwise broom grass, briers and other weeds will in a few years destroy it.

To make good hay and the largest yield, this grass must be mowed from three to five times every summer. Thus briers, broom grass and other weeds are also repressed and prevented from seeding, multiplying and ruining the meadow. Properly managed this grass grows from ten to fifteen inches high.

It may be known from other grasses similar in appearance; when in bloom by the stem bearing at the top from three to five digitate spikes; and at all times by having two leaves to each joint, frequently three and sometimes four; while no other grass of like appearance has more than one leaf to the joint. The sheaths of the alternating leaves are so close-fitting and project one beyond another in such a way that unless these are stripped off one would think there was a joint to each leaf.

Propagation. This grass having but one fertile flower to each spikelet and one flower in a hundred, a thousand, or million perhaps maturing seed in this country, trying to save the minute seed from it would be as bootless as seeking "a grain of wheat in a bushel of chaff," or "a needle in the hay stack." I am convinced and have long insisted that it matures some seed; and there are many facts tending to establish this opinion. But these seed are so few, however, that practically they are agriculturally as if they were not. Hence we have no means within our own country of propagating it except by cuttings of the underground stems and the superficial runners.

These may be prepared by taking up the sod of any convenient size with a thickness of about two inches of soil adhering. Turn the pieces grass side down and with a sharp spade cut rapidly through the sod two ways so as to make pieces one or two inches square. Set the pieces right side up in the intersections of small shallow furrows made two feet apart each way with a coulter or narrow opener, on the previously prepared land. The soil may be adjusted to the pieces by means of the hoe or by a very light furrow from a narrow shovel. With a few light plowings the land will soon be fully occupied by the grass. Some prefer washing all the soil from the sods and then passing them through a cutting box. The pieces are then scattered over the prepared land and plowed in. In either plan after planting, passing a roller over the ground will benefit.

Destroying. 1st,, Keep stock from it and leave it alone. Broom grass, briers, and weeds in a few years will destroy it. This plan is not good farming. 2nd., It roots two inches deep. When expecting a drought in summer, turn up the soil from a depth of two inches; best turned edgewise and not upside down; after a few days' drying run a toothed rotary harrow over several times in every direction. Thus most of the soil will be

shaken from the roots; these will be in little piles and may be easily forked into larger ones and burned or hauled away, to set other lands or otherwise disposed of. This also is bad practice unless the operation is performed late, say in August or September and the ground immediately sown with small grain, as wheat, oats or barley; or done early, say June, and the ground sown with peas broadcast before harrowing, as thus the peas would be covered by the same process which clears the land of the grass roots. Then in October the peas should be followed by small grain—barley preferably if to be harvested, as the other grains would probably grow too tall. In the spring the barley would be harvested in time to be followed by cotton, corn or potatoes, either of which would afford an abundant harvest.

3. A third plan is to turn the sod with two inches of earth up edgewise in the winter. A few freezes will kill most of the roots and at dry times these may be collected by the rotary harrow. Or without the harrowing the ground may be bedded in the spring for cotton. The grass will give little trouble and two years' neat culture in cotton will clear the land of Bermuda grass. From this it may be seen how my friends who keep this grass on their cultivated lands manage it (not allowing too clean culture) and make better crops than those who keep it off their lands.

4. Unless plenty of stock is kept on this grass from April till autumnal frosts, as intimated on another page, where Lespedeza striata grows well, it will exterminate the Bermuda grass.

Eleusine.

E. indica, Yard Grass.

This is called also crop grass, crab grass, wire grass, dog's-tooth grass and crow-foot grass. All these names applied in different localities to the same plant and in other localities to twenty other plants show the impossibility of identifying plants by their popular names. The flexibility, toughness and strength of the culms well entitle it to the name of wire grass. The clumps have many long leaves and stems rising one or two feet high and many long, strong, deeply penetrating fibrous roots. It grows readily in door yards, barn yards and rich cultivated grounds, and produces an immense quantity of seeds. It is a very nutritious grass and good for grazing, soiling and hay. The succulent lower part of the stems covered with the sheaths of the leaves renders it difficult to cure well, for which several days are required. It may be cut two or three times and yields a large quantity of hay.

Mr. Collier's analyses of samples from three States follows:

	Texas.	Georgia.	Alabama.
Oil,	1.78	1.72	2.27
Wax,	.38	.35	.29
Sugars,	11.92	13.29	8.69
Gum and dextrin,	6.33	5.84	4.98
Cellulose,	31.29	22.38	21.53
Amylaceous cellulose,	25.46	26.37	21.97
Alkali extract,	.00	10.44	20.97
Albuminoids,	13.72	13.28	12.23
Ash,	9.12	6.32	7.07
	100.00	100.00	100.00

ANALYSIS OF ASH.

	Texas.	Georgia.	Alabama.
Potassium,	9.52	7.39	4.55
Potassium oxide,	10.27	24.79	30.98
Sodium,	1.26	——	3.55
Sodium oxide,	——	——	——
Calcium oxide,	10.27	13.65	11.10
Magnesium oxide,	4.10	7.38	5.57
Sulphuric acid,	4.24	5.79	8.55
Phosphoric acid,	2.69	9.68	9.84
Silicic acid,	47.56	24.61	16.25
Chlorine,	10.09	6.71	9.61
	100.00	100.00	100.00

A few planters encourage the growth of this grass on lots specially assigned to it and mow regularly one, two or more tons per acre per annum.

DACTYLOCTENUIM.

D. EGYPTIACUM, Crow-foot Grass. This grass very much resembles the Eleusine in general appearance and character, though not quite so nutritious and nice. The culms ascend from a creeping base, bearing, at the top, usually four spikes awn-pointed, and one or two inches long, the spikelets three-flowered. The upper glume is awn-pointed and palets pointed. The flattened culm of Eleusine bears from two to many spikes two to five inches long, the lower ones scattered, spikelets six-flowered, glumes and palets pointless. Mr. Collier's analysis is subjoined:

Oil,	1.64	Amylaceous cellulose,	31.63
Wax,	.32	Alkali extract,	16.46
Sugars,	10.96	Albuminoids,	9.01
Gum and dextrin,	5.60	Ash,	6.90
Cellulose,	17.48		100.00

Analysis of ash.

Potassium,	7.50	Sulphuric acid,	4.42
Potassium oxide,	21.20	Phosphoric acid,	8.37
Sodium,	——	Silicic acid,	24.17
Sodium oxide,	——	Chlorine,	6.76
Calcium oxide,	20.67		
Magnesium oxide,	6.91		100.00

Leptochloa.

L. mucronata, Feather Grass.

This grass is an annual, having long, broad, rough leaves with hairy sheaths, and culms two to three or more feet high, the latter terminating in panicles one or two feet long, with many slender elongated branches, bearing the small spikelets—altogether presenting a peculiarly light feathery appearance of great beauty. It grows on cultivated lands and especially where Eleusine grows well. Its growth is very rapid, although it has little root and it is easily uprooted.

After its attractiveness to the eye and roughness to the touch, the next most striking property of this grass is its lightness even in its greenest state. Although it contains a good per centage of nutritious matters, it is of little agricultural value. Its assurgent leaves and stems and immensely large panicles occupy so much space that a comparatively small number of plants would occupy an acre of land, while it has so little weight that the product of several acres of the finest growth of it would be required to produce a single ton of hay. Stock eat it with relish when unmixed; but in grazing horses reject it among other grasses. Here follows Mr. Collier's

Analysis of Leptochloa mucronata:

Oil,	1.68	Amylaceous cellulose,	23.69
Wax,	.40	Alkali extract,	11.55
Sugars,	7.33	Albuminoids,	7.80
Gum and dextrin,	6.41	Ash,	8.98
Cellulose,	32.16		
			100.00

Analysis of ash.

Potassium,	1.81	Sulphuric acid,	3.31
Potassium oxide,	20.21	Phosphoric acid,	6.46
Sodium,	.80	Silicic acid,	55.92
Sodium oxide,	——	Chlorine,	2.89
Calcium oxide,	5.94		
Magnesium oxide	2.66		100.00

BUCHLOA.

B. DACTYLOIDES. Buffalo Grass.

Mr. S. B. Buckley of Austin, Texas, makes the following statements about this grass:

"This is one of the best grasses of Texas for pasturage, if not the very best; being perennial, it affords food for stock both summer and winter. Even in midwinter it presents a green covering over many hills and prairies in this vicinity. It is also the best grass for lawns indigenous to Texas. It is not confined to the State, but extends over the western plains to the Rocky Mountains, as far north as Missouri, and perhaps farther. It thrives on every variety of soil, growing on poor, gravelly uplands, and also in rich river bottoms, but it mostly abounds on the prairies among the mesquit trees, scattered over their surface throughout a large portion of our State, whence it is commonly called mesquit grass in Texas. This name, however, is given to two or three other species of grass which are often associated with it. On the western plains it is known by the name of buffalo grass, hence its botanic name (*Buchloa.*)

"It seldom grows more than six or eight inches in height, in flowering stems, but its leaves are long. It also grows by stolons or runners, by which means it extends rapidly and soon covers the surface. Unlike most grasses it is dicecious, that is, it has male and female flowers on different stems; the female flowers and seed are near the root, and seldom seen or noticed unless search is made for them. On this account its true nature was long unknown to botanists, its male flowers only having been collected. I have been told by many people in Texas that it does not bear seed. When in flower it can easily be known from every other species of mesquit by its upright staminate or sterile flowering stems, with one or two short, horizontally extending branches, one or two inches long, densely crowded with yellowish brown florets.

"The *Buchloa* is not difficult to eradicate, nor is it ever troublesome in cultivated fields, because it has so few seeds. No one need fear introducing it on his plantation, either for lawns or pasturage. All kinds of stock are extremely fond of it, from which we infer that it is very sweet and nutritious. To the people of Texas it is certainly one of the most valuable grasses for pasturage, yielding as it does an abundance of food both winter and summer, nor do the droughts of summer hurt its vitality. In extreme droughts often all the grasses seem dead, but a rain will make this mesquit grass green and growing in a few hours. Even when dry, weather-beaten and seemingly dead, it is still good food for stock."

Mr. H. W. Ravenel writes of this grass as follows: "This remarkable grass is found 'in the western prairies, from the Brit-

ish Possessions throughout to Missouri Territory, Nebraska, Kansas and New Mexico, down to Texas and North Mexico,' and well known to herdsmen and hunters under the name of *Buffalo grass*. I saw it in 1869 in Texas, growing abundantly a few miles from Corpus Christi, and in the prairies near Indianola; and it was there called '*Meskit grass*.' It was represented as one of their best pasture grasses for their herds of cattle, nutritious and always preferred by animals to any other.

"The grass has the peculiarity (possessed by very few other grasses) of bearing its male and female flowers on separate plants, (and called in botany dicecious.)

"The male plants are the largest, growing from six to twelve inches high, and being most conspicuous, are those most frequently seen and noticed. They grow in dense tufts, and from these send out their shoots.

"The true *Meskit grass* is *Boutelova hirsuta*, growing also in the Western Prairies."

The buffalo grass certainly should be more widely cultivated on our southern waste lands, lawns, and pastures. It is often confounded with

Boutelova, Mesquit Grass.

Three species of this grass grow in the west, and are known by various names, as gramma, (not gama from which it is totally different) mesquit, with the many ways of spelling, etc. The bristly mesquit grows abundantly in Texas in tufts from 8 to 20 inches high. It is a valuable grass and has been experimented with in many parts of the south with gratifying results. Perhaps the other two species have also been tried under the general name of mesquit. But this name has been applied to a number of other grasses and caused no little confusion. Many specimens of so called mesquit grass have been sent to me from Texas and from several other states, (the seeds having been first obtained from Texas) and in every instance it has proved to be *Holcus lanatus*, velvet, or soft meadow grass. And it is this velvet grass, naturalized in Texas, that is generally cultivated in the southern States under the name mesquit.

Eatonia.

1. E. pennsylvanica. Eaton's Grass.

The Eatonias are slender, erect, tufted, perennial grasses with narrow leaves, and small, smooth, shining spikelets of pale flowers in a panicle. In this species the panicle is slender, loose; the two- or three-floweed spikelets; scattered on the slender branches; stems one or two feet high, flowering in April and found

in borders of woods. Cattle seem to relish it better than other grasses growing in forests.

2. E. OBTUSATA. This differs from the preceding in having a dense, spike-like panicle, with two-flowered spikelets much crowded on the short, erect branches. These grasses are of little agricultural value. In Darby's Botany of the southern States, they are mentioned under the names *Aira mollis* and *A. obtusata* respectively, thus classing them with the *hair grasses*.

MELICA.

M. MUTICA, Melic Grass.

This perennial grass with stems one or two feet high blooms in April, growing in dry, open woods. Its three- to five-flowered spikelets, few, nodding and arranged in a loose, simple panicle. Though eaten by stock, it is of little value. The *M. diffusa* and *M. Muhlenberghia* are similar and scarcely worth mentioning.

GLYCERIA.

1. G. NERVATA, Meadow spear Grass. This is called nerved manna grass also. In the eastern States, some farmers call it fowl meadow grass. But it must be distinguished from *Poa serotina*, every where else known as true fowl meadow grass and described on another page. It has a creeping, perennial root; erect stems, two or three feet high; diffuse panicle, the capillary branches at length drooping; the rachis separating into joints; spikelets rounded, purplish, five- or six-flowered, small; leaves in two rows like a fan. It grows naturally in wet swamps; but will succeed on good upland soil also.

Although a native, nutritious grass, it has received little attention in this country. Sinclair in the Woburn experiments, however, made some remarkable statements in regard to it and held it in high esteem. He stated that in February, 1814, after the severe preceding winter, this grass was green and succulent, while out of nearly three hundred species that grew around it not one remained healthy, but all were injured and rendered inferior by the severe weather.

He found also that the quantity and nutritive quality of this grass was the same or equal whether cut at the time of flowering or when the seed were ripe, which was not the case with any other grass tested at that time. The aftermath was also remarkably valuable; for after the seed mature, it sends up large fan-like shoots which are succulent and even more nutritious than the leaves. It is certainly worth trying on our marshy or moist lands. It blooms in June and July.

2. G. PALLIDA. Pale Manna Grass, grows in shallow water,

with perennial roots: culms creeping at the base, one to three feet long, panicle erect, narrow, nearly simple; spikelets rounded, five- to nine-flowered, half inch long, pale, leaves short, sharp pointed, pale green. It is of little agricultural value from the fact that although nutritious, it cannot be mowed or cultivated conveniently, growing as it does in water.

3. G. FLUITANS, Common Manna Grass, or Floating Manna Grass, growing in shallow water, produces culms from one to five feet long with panicle one foot long in June or July, from the perennial, creeping roots; leaves long, broadly linear. It differs from the other species markedly in its slender long panicle and few long linear spikelets. It grows in cultivation on permanently moist lands, and its yield compares favorably with many other good grasses. It is cultivated in France and many other portions of Europe. The seeds whole or ground into meal or flour are nourishing and used in soups and broths This grass is eaten with avidity by horses, cattle, sheep and swine, and the seeds by birds.

4. G. RIGIDA, another species indigenous also to the southern States and growing on dry soils, seems to possess little value and attract no attention.

Several other species of manna grass are native in our eastern and northern States; but none of them native or cultivated in the south, except the

5. G. CANADENSIS, Rattlesnake grass sometimes found in gardens. It has a long, pyramidal, spreading panicle, with handsome, drooping spikelets; has the general appearance of quaking grass; and is used for bouquets and vases. It is of little agricultural value.

Poa.

1. P. PRATENSIS, Kentucky Blue Grass.

This is called also smooth meadow grass, spear grass, and green grass, all three very appropriate, characteristic names. Blue is a misnomer for this grass. It is not blue, but 'green as grass' and the greenest of grasses. The *P. compressa*, flat-stalked meadow grass, wire grass, blue grass is blue, the 'true blue' grass from which the genus received its trivial name.

Kentucky blue grass, known also in the eastern States as June grass, although esteemed in some parts of America as the best of all pasture grasses, seems not to be considerered very valuable among English farmers except in mixtures. It is certainly a very desirable pasture grass however. Its very narrow leaves, one, two or more feet long, are in such profusion and cover the ground to such depth with their luxuriant growth that a mere description could give no one an adequate idea of its beauty, quantity and value; that is on rich land. On poor, sandy land it degenerates sadly as do other things uncongenially located.

Perennial and bearing cold and drought well, it furnishes grazing a large part of the year. It is specially valuable as a winter and spring grass for the south. To secure the best winter results, it should be allowed a good growth in early fall, so that the ends of the leaves being killed by frost afford an ample covering for the under parts which continue to grow all winter and afford a good bite whenever required by sheep, cattle, hogs and horses. In prolonged summer drought it dries completely, so that if fired, it would burn off clean. But this occurs in Kentucky, where indeed it has seemed without fire to disappear utterly; yet when rain came, the bright green spears promptly recarpeted the earth.

With its underground stems and many roots it sustains the heat and drought of the southern States as well as those of Kentucky; where indeed it is subjected to severer trials of this kind than in the more southern States. In fact it bears the vicissitudes of our climate about as well as Bermuda grass and is nearly as nutritious.

Mr. Collier's proximate

ANALYSIS OF POA PRATENSIS:

Oil,	1.82	Amylaceous cellulose,	22.53
Wax,	1.04	Alkali extract,	17.20
Sugars,	9.61	Albuminoids,	11.54
Gum and dextrin,	3.14	Ash,	5.18
Cellulose,	27.94		
			100.00

ANALYSIS OF ASH.

Potassium,	6.96	Sulphuric acid,	4.76
Potassium oxide,	33.81	Phosphoric acid,	9.89
Sodium,	——	Silicic acid,	30.25
Sodium oxide,	——	Chlorine,	6.30
Calcium oxide,	4.81		
Magnesium oxide,	3.23		100.00

Blue grass grows well on hill tops, slopes, or bottom lands if not too wet and too poor. It may be sown any time from September till April, preferably perhaps in the latter half of February or early in March. The best catch I ever had was sown the 20th. of March, on unbroken land, from which trash, leaves etc. had just been burned. The surface of the land should be cleaned of trash of all kinds, smooth, even; and if recently plowed and harrowed, it should be rolled also. This last proceeding is for compacting the surface in order to prevent the seed from sinking too deep in the ground. Without harrowing or brushing in, many of them get in too deep to come up, even when the surface of the land has had the roller over it. The first rain after seeding will put them in deep enough, as the seeds are very

minute and the spears of grass small as fine needles and therefore unable to get out from under heavy cover. These spears are so small as to be invisible except to close examination and in higher latitudes this condition continues through the first year. Thus some who have sown the blue grass seed, seeing the first year no grass imagine they have been cheated, plant some other crop and probably lose what close inspection would have shown to be a good catch. This, however, is not apt to occur in the southern tier of States as the growth here is more rapid. The sowing mentioned above, made on the 20th. of March, came up promptly and in three months the grass was from six to ten inches high. One year here gives a finer growth and show than two in Kentucky or any other State so far north.

Sown alone 20 to 26 pounds, that is two bushels, should be used; in mixtures, four to six pounds.

2. P. ANNUA, Annual Meadow Grass.

In many parts of the southern States this grass has become naturalized. It is a tender plant, with linear leaves three to six inches long and stems six to ten inches high, blooming in February and March, and through the summer if moist. It is a beautiful grass, but so small that the yield is not large. But it is exceedingly relished by all kinds of cattle and is supposed to have a specially good effect in improving the quality of butter. It does not resist the effects of drought as well as other species of this genus. It is so very like blue grass (*P. pratense*) as to be easily mistaken for it. In some places it is called goose grass.

3. P. CRISTATA, six to ten inches high, and

4. P. FLEXUOSA, Southern spear grass, with slender stems twelve to eighteen inches high, are southern species growing in dry wooded lands. They have not been tested to ascertain their agricultural value. They bloom respectively in April and May.

5. P. COMPRESSA. This is the Blue or Wire grass of the north. It has priority of claim to the name *blue* grass and justly too as the leaves have a deep bluish green tint. It differs from the Kentuckey blue grass in the deeper tint of the foliage and flattened stems. The stems are decumbent at the base, the middle portion ascending and the upper erect, with panicle dense, contracted at first, but later expanding. It grows one or two feet long and is very hardy, and thrives on poor, hard, trodden soils, sandy knolls and rocky places. It is very nutritious and greatly relished by all kinds of cattle. Cows fed on it produce very rich milk and finely-flavored butter. Its thick rich turf renders it specially agreeable to sheep and deer and it imparts a delicate flavor to their flesh.

Its stems retain the deep bluish green color after maturing the seeds. Shrinking less than most other grasses in drying, it makes a very heavy hay in proportion to bulk. Both in Eng-

land and our northern States it is very highly esteemed as a pasture grass. It is found naturalized or native in nearly all the southern States.

In cultivated lands it is difficult to eradicate; and how to destroy it has caused more discussion at the north, than how to eradicate coco and Bermuda grasses at the south.

6. P. TRIVIALIS, Rough-stalked Meadow Grass.

This also much resembles the Kentucky blue grass. But it may be readily distinguished by noting that it has rough sheaths, with long, pointed ligules, the marginal ribs of the five-ribbed outer palet not hairy, and the roots fibrous. In blue grass, the sheaths are smooth, ligules obtuse, marginal ribs of outer palet hairy, and roots creeping. The stems are two or three feet high.

According to Way's analysis, it contains, albuminoids, 9.80; fatty matters, 3.67; heat producing principles, 40.17; woody fibre, 38.03; ash, 8.33, in 100 parts of the dry grass.

This is a nutritious grass, greatly relished by cattle, horses and sheep. Although perennial and yielding a large quantity of good hay, it is liable to be killed, in the south, by cutting unless succeeded by cloudy wet weather. In England and on the continent this is a favorite grass, being very small on poor soils; but on rich, moist loams tall, yielding a large quantity of herbage. In a meadow peculiarly well adapted to it near Salisbury Plain it is said to have been found eight feet long.

It is specially adapted to wood pastures, as it delights in shade, banks of streams and moist grounds generally. It bears tramping and is an excellent pasture grass. It makes a good mixture with red top and orchard grass, or red top and tall oat grass, and with other pasture grasses. Eight to ten pounds seed may be sown to the acre; a bushel weighing fifteen pounds.

P. NEMORALIS, Wood Meadow Grass, as the name implies, prefers wooded lands; and it luxuriates in moist shaded grounds or watery swamps. It has a perennial, creeping root; erect, slender, smooth stem, one and a half to two feet high, with long, finely arched panicle; and blooms in May and June. It is of rank growth, succulent, nutritious, and cattle are fond of it. It may be planted in September, October and February, four pounds seed per acre.

8. P. BREVIFOLIA, Short-leaved Spear Grass, with stem leaves short, radical leaves nearly as long as the stems, is found in rocky, hilly woodlands.

9. P. ALSODES, Wood Spear Grass, with narrow, acute leaves, the upper ones often sheathing the lower part of the panicle, the slender branches of which are generally in threes or fours, is found in hilly woods flowering in April or May.

10. P. DEBILIS, Weak Meadow Grass, is perennial, growing in rocky woodlands, flowering in April and May, with panicle small, loose, few flowered, and branches slender, flexuous, in pairs o rtriplets.

11. P. sylvestris, Sylvan Meadow or Spear Grass, has a flat, erect stem and short pyramidal panicle with numerous branches in fives or more. It is a light, tender grass and found in rocky woods.

All these last named grasses grow so scattering as to be of little value.

A few other species of Poa are found in our northern States, of no value there and not worth introducing any where, except the following one:

12. P. serotina, Fowl Meadow Grass.

This grass belongs to the same genus that the Kentucky blue grass does. Being taller, (culms 2 to 3 feet) it is specially adapted to moist or even wet lands. It makes a large quantity of excellent hay; but it has not been sufficiently cultivated in in the southern States, so far as I am aware, to know how long a meadow set with it may remain profitable. It is however, worthy of extended trial; and that its comparative nutritive value may be known, Mr. Collier's analysis is annexed:

Analysis of poa serotina.

Oil,	1.95	Amylaceous cellulose,	25.24
Wax,	1.53	Alkali extract,	15.19
Sugars,	9.33	Albuminoids,	8.91
Gum and dextrin,	7.49	Ash,	7.47
Cellulose,	25.62		
			100.00

Analysis of ash.

Potassium,	2.79	Sulphuric acid,	3.35
Potassium oxide,	31.71	Phosphoric acid,	10.80
Sodium,	.83	Silicic acid,	37.10
Sodium oxide,	——	Chlorine,	3.80
Calcium oxide,	6.70		
Magnesium oxide,	2.92		100.00

In portions of the western States this grass has for some years been very highly recommended. In the eastern States it has been cultivated for 150 years or longer and valued highly. Jared Eliot in 1749, spoke of it as growing tall and thick, making a more soft and pliable hay than timothy and better adapted for pressing and shipping for use of horses on shipboard. He says it makes a thick, abundant growth on land more moist than is adapted to common upland grasses and may be mowed any time from July to October, as it never becomes so coarse and hard but the stalk is sweet and tender and eaten without waste. It is a nutritious grass and easily made into valuable hay. It is superior to other grasses in its property of remaining tender and good for so long a time after first bloom-

ing. As it constantly sends up flowering stems from the joints, the lattermath contains more nutrition than the first crop at the time of blooming. The more I see and know of its growth in the southern States the more am I pleased with it.

TRICUSPIS.

T. SESLEROIDES, Tall red-top Grass.

This is a perennial grass with long rigid leaves and culms, from three to five feet high, crowned with large diffuse panicles. The scattered, pedicelled, purple spikelets give the grass a fine appearance. It grows on dry, sterile soils. Although not very nutritious nor desirable in cultivation, yet where it grows naturally and one has nothing better, it may be worth cutting and curing for feeding cattle in conjunction with concentrated food in winter. Its comparative value will be seen from Mr. Collier's subjoined analysis:

ANALYSIS OF TRICUSPIS SESLEROIDES.

Oil,	1.81	Amylaceous cellulose,	26.45
Wax,	.24	Alkali extract,	12.63
Sugars,	6.98	Albuminoids,	6.32
Gum and dextrin,	3.16	Ash,	4.55
Cellulose,	37.86		
			100.00

ANALYSIS OF ASH.

Potassium,	8.13	Sulphuric acid,	4.04
Potassium oxide,	38.49	Phosphoric acid,	1.58
Sodium,	——	Silicic acid,	37.52
Sodium oxide,	——	Chlorine,	7.39
Calcium oxide,	2.32		
Magnesium oxide,	.53		100.00

ERAGROSTIS.

E. REPTANS, Creeping Meadow Grass, is a beatiful annual, with long creeping roots, stems six to eighteen inches high, panicles one or two inches long, spikelets ten- to thirty-flowered, leaves nearly awl-shaped one or two inches long, flowers in July, whole plant pale green, and found in low, sandy places, gravelly banks of streams, fence corners and open pastures. It is relished by cattle, but not of much value in agriculture.

2. E. POÆOIDES, Strong-scented Meadow Grass, is handsome also. The variety *E. megastachia*, Pungent Meadow Grass is very pretty, but emits a disagreeable odor. The stems are prostrate, geniculate at the base, ascending; panicles contracted ob-

long, or later pyramidal spreading; spikelets oblong or later linear, three to five lines long, ten to thirty flowered, often lead colored; leaves linear; sheaths smooth; flowers in July and August; found in waste or cultivated lands. Stock do not relish it.

3. E. PILOSA, Slender Meadow Grass, is a pretty annual, six to twelve inches high, with loose pyramidal panicle; spikelets five- to twelve-flowered, of purplish lead color. It is found in sandy gravelly barrens and old fields, affording some acceptable, nutritious food for cattle.

4. E. PURSHII, Southern Spear Grass, has stems six to twelve inches long, slender, geniculate near the base, ascending; panicle three to six inches long, loose, widely spreading, the lower branches whorled; spikelets five- to ten-flowered, pale or purple; blooms from June to September. It is found in cultivated grounds and waste lands, and is of little value for stock.

5. E. CONFERTA, with stems two or three feet high and panicles one or two feet long, whitish, found on river banks, blooming in August and September.

6. E. TENUIS, Branching Spear Grass, with panicle one to two and a half feet long and spreading branches; leaves one to two feet long; flowering from August till frost and found on river banks and rich sandy soils.

7. E. CAPILLARIS, Hair-panicled Meadow Grass, with loose, delicate, widely expanding panicle, one or two feet long; spikelets very small, mostly purple, on long diverging capillary pedicels; flowering in August and September; and found in sandy, dry, waste places.

8. E. PECTINACEA, Meadow Comb Grass, with panicle one to one foot and a half long, widely diffuse, or the branches finally reflexed; spikelets purple, flat; flowering in August and September; and growing on dry, sterile soils; the dry panicles wafted about by the winds; and

9. E. NITIDA, Shining Eragrostis, growing along the coast with panicles one and a half to three feet long; blooming in August and September; the leaves and sheaths shining;—are all of little agricultural value. Some of the species of this genus are beautiful in bouquets and vases; and for those uses they have been cultivated in lawns and gardens. That etymology may be correct which derives Eragrostis from Eros (of whom the unfortunate Er of Genesis may be the original,) and therefore calls it Love Grass.

Though it may be named from *era*, earth, from some of the species having stems partly prostrate on the earth.

Dactylis.

D. GLOMERATA, Orchard Grass, Rough Cock's-foot.

Leaves broadly linear, very long, rough, bluish green; panicle with few scattered branches below, more dense at top; spike-

lets about three- or four-flowered, in densely crowded, one-sided clusters; both glumes and lower palet awn-pointed; stamens three; seed oblong, acute, free; roots perennial, fibrous, long, penetrating the soil deeply; stem three feet high and on good soil often five feet; flowering in the southern States from the last of April till July first, according to latitude, character of season and treatment.

Of all grasses, this is one of the most widely diffused, growing in Africa, Asia, every country of Europe and all our States. It is more highly esteemed and commended than any other grass, by a larger number of farmers in most countries—a most decided proof of its great value and wonderful adaptations to many soils, climates and treatments. Yet, strange to say, though growing in England for many centuries, it was not appreciated in that country till carried there from Virginia in 1764. But, as in the case of timothy, soon after its introduction from America, it came into high favor among farmers and still retains its hold on their estimation as a grazing and hay crop.

Nor is this strange when its many advantages and points of excellence are considered. It will grow well on any soil containing sufficient clay and not holding too much water. If the land be too tenaceous, drainage will remedy the soil; if worn out, a top dressing of stable manure will give it a good send off and it will furnish several good mowings the first year. It grows well between 29° and 48° latitude. It may be mowed from two to four times a year according to latitude, season and treatment; yielding from one to three tons of excellent hay per acre on poor to medium land. In grazing and as hay most animals select it in preference among mixtures with other grasses. In lower latitudes it furnishes good winter grazing, as well as for spring, summer and fall. After grazing or mowing, few grasses grow so rapidly, (three or six inches per week), and are so soon ready again for tooth or blade. It is easily cured and handled. It is readily seeded and catches with certainty. Its long, deeply penetrating, fibrous roots enable it to sustain itself and grow vigorously during droughts, that dry up other grasses, except tall oat grass, which has similar roots and characters. It grows well in open lands and in forests of large trees, the under brush being all cleared off. I have had it grow luxuriantly even in beech woods where the roots are superficial, in the crotches of roots and close to the trunks of trees. The hay is of high quality, and the young grass contains a larger per cent of nutritive digestible matter than any other grass. It thrives well without renewal on the same ground for thirty-five, nay forty years; how much longer I am not able to say. It is easily exterminated when the land is desired for other crops. Is there any other grass for which so much can be said?

I know but one objection to it. Like tall oat grass, it is disposed to grow in clumps and leave much of the ground uncovered. This may be obviated by thick seeding, using two and a half or better three bushels of seed per acre. It will not do to seed thinly with the hope that seeds grown on the plants will fall, germinate and fill the gaps. They will not germinate when so falling, although when properly sown on prepared soil, it is one of the most certain grasses to make a good catch.

The gaps may be prevented by sowing with it a few pounds of red top seed. But as the latter multiplies annually from seeds dropping, it would in a few years root out the orchard grass. In common with others, I prefer red clover with orchard grass. It fills the gaps and matures at the same time with orchard grass; the mixture makes good pasture and good hay. But if mowed more than twice a year, or grazed too soon after the second mowing the clover will rapidly fail. One peck of red clover seed and six pecks of orchard grass seed is a good proportion per acre.

Whether it is more profitable to mow orchard grass but twice a year and thus have earlier, better and more prolonged winter pasture; or to mow three or four times and have later, inferior and for a shorter time, winter pasture, is a question affected by so many contingencies and permutations that the satisfactory discussion would be so complex and occupy so many pages that it is deemed proper not to entertain it here; but leave it for each reader to decide from his own stand-point in view of his own purposes, objects and surroundings. I decidedly prefer for my own purposes and with my own experience but two mowings a year of the mixed clover and orchard grass and not more than three of orchard grass alone and this only if the season be very favorable. It should not be grazed soon after mowing if good, early winter pasture be expected.

"This valuable grass is indigenous to the soil of America, and from its adaptability to various soils, its early and late growth, luxuriant foliage and nutritive qualities, is well entitled to an equality with any grass either native or foreign."—(*Henderson.*) I therefore give several analyses. Taken green from the field and in bloom, 100 parts gave:

According to—	Way.	Schevan and Ritthausen.
Water,	70.00	65.00
Albuminoids,	4.06	3.00
Fatty matter,	.94	.80
Carbohydrates,	13.30	12.60
Woody fibre,	10.11	16.10
Ash,	1.59	2.40
	100.00	99.90

100 parts of the dried grass gave according to analysis of	Way.	Wolff & Knop.
Albuminoids,	13.53	11.60
Fatty matter,	3.14	2.70
Carbohydrates,	44.32	40.70
Woody fibre,	33.70	28.90
Ash,	5.31	4.60
	100.00	88.50

These apparent discrepancies are what must be expected of any other grass grown under different conditions and cut at different stages of maturity. Mr. Sinclair's Woburn experiments well illustrate this. Grown on rich sandy soil, he cut of this grass immature, 10,209 pounds per acre containing 1,190 pounds nutritive matter. Cut in flower, an acre gave 27,905 pounds green, or 11,859 pounds dry hay containing 1,089 pounds nutritive matter. Cut in seed it weighed per acre 26,544 pounds fresh, or 13,272 dry, containing 1,451 pounds nutritive matter. Cut in this last mature stage, it is much more difficult to masticate and digest, and a less proportion of the nutritive matter is assimilated. It should, therefore, be cut at an earlier stage to secure the healthiest relish and most nutriment for green soiling or hay.

Altogether and from every stand point, I am compelled to say still as I did many years ago that I prefer orchard to any other grass. Nor am I alone in this preference. I could fill volumes with testimonials more strongly expressed than my own in favor of this grass over all others, by the most distinguished live stock growers of Europe and America.

After being cut, it has been found to grow four inches in less than three days. Sheep leave all other grasses, if they can find this; and acre for acre it will sustain twice as many sheep or other stock as timothy or other esteemed pasture grasses. Cut at the proper stage it makes a much better hay than timothy and is greatly preferred by animals, being easier to masticate, digest and assimilate; in fact more like green grass in flavor, tenderness and solubility. It grows on any soil not too wet or too salty; on hill and vale, mountain and plain.

It produces seeds freely and they germinate with certainty. A bushel of cleaned seeds weighs from twelve to fifteen pounds. It may be be improved by selecteng seeds from choice plants. Probably all the cereals, certainly all that I have tried, may be greatly improved by careful selection and judicious culture.

FESTUCA. Fescue Grasses.

Native and introduced, eight species of this genus are found growing in the southern States. These range from two inches

to four feet high. Two or three of the species are worth little or nothing; but others are among the most valuable grasses we have.

1. F. PRATENSIS, known generally as meadow fescue, locally in Virginia as Randall grass, is a perennial, with round smooth stems two to three feet high, in mountain lands in Virginia six feet high, panicle nearly erect, branched, slightly inclined to one side. The radical leaves are broader than those of the stem; but in other species this is reversed. The numerous fibrous roots pierce a good soil to a depth of 12 or 15 inches. It is therefore better fortified against drought than most grasses, and it is in vigorous growth when other grasses are dried up. It is one of our best winter grasses and is much prized as far north as Virginia, where it furnishes cattle good grazing in mid-winter, as they can push their muzzles under the snow to crop it. They are very fond of the long tender leaves, which are enjoyed by horses and sheep also.

It grows well in nearly all situations, wet or dry, on hill or bottom land, even though subject to overflow, and matures an extraordinary quantity of seed. The seeds germinate readily, and it is easy to set a piece of land with this grass. Seeded alone, 28 pounds (about two bushels seed should be sown broadcast in August, September, October or from the middle of February to first of April. From remaining green through winter it is sometimes called evergreen grass. Mowed and dried it makes a good hay much relished by stock. It may therefore be used for pasture, green soiling or hay as desired.

Sinclair found more nutritive matter in the fescue grass when in bloom than when in seed. In this fact there is great advantage in favor of these grasses; for being cut when in bloom they are more easily and completely digested than when cut later, and hence a larger production of the contained nutritive matters can be assimilated by the animal eating them.

2. F. ELATIOR, Tall Fescue grass. Some consider this identical with the meadow fescue; but it is about twice as large, has similar perennial roots, stems 3 to 4 or 5 feet high, panicle a little drooping or erect, with short branches spreading in all directions. According to the Woburn experiments it furnished a much larger quantity of nutritive material than any of the other fescues and a larger quantity than a number of other forage plants, timothy making the nearest approach to it, and blue grass rating extremely low in the scale. The gross weight of grass was so great, the loss in drying so much less than in others and the nutritive matter so extraordinary in quantity that the reader will be interested in a comparative table which I have constructed from Sinclair's report of the Woburn experiments, which he conducted for ten years.

	When cut.	weight green.	Weight dry.	Nutritive matter.	
Festuca elatior,	In flower,	51,046	17,866	3,938	Tall fescue grass.
Festuca duriuscula,	"	18,376	8,269	1,034	Hard fescue grass.
Festuca pratensis,	"	13,612	6,465	957	Meadow fescue grass.
Festuca foliacea,	"	16,335	7,146	765	Spiked fescue grass.
Holcus lanatus,	"	19,057	6,661	1,191	Meadow soft grass.
Holcus odoratus,	In seed.	27,225	9,528	2,223	Sweet M. soft grass.
Dactylis glomerata,	"	26,541	13,272	1,454	Orchard grass.
Trifolium pratense,	"	49,095	12,273	1,914	Red clover.
Phleum pratense,	"	49,837	19,397	3,669	Timothy.
Poa pratense,	In flower,	16,269	2,571	279	Kentucky blue grass.

Sinclair's experiments show: 1st. that meadow fescue between the times of blooming and maturing seed, loses $\frac{2}{3}$ of its nutritive value; or that it has three times as much nutritive materials when in bloom as when the seed are ripe: 2nd. that the produce of tall fescue was to that of meadow fescue as 2 to 1; and 3rd. that the percentage of nutritive matter in the former to that in the latter was as 8 to 6; and finally that the nutritive value of an acre of tall fescue was four times greater than that of an acre of meadow fescue, more than twice that of red clover, and equalled by that of lucerne alone. In preparing the above table I have taken each plant at that stage in which it contains the largest quantity of nutrition. The fescue grasses cut in bloom are more digestible and their nutritive value enhanced no little as compared with the other plants named in the table cut at a stage when less digestible.

Of all the nutritive matter contained in fescue grass, 20 per cent forms flesh and 9 per cent bone nerve etc., just the thing for the rapid development of young animals. Weight for weight, however, red clover furnishes much more of flesh and bone forming materials than the grasses. The table will enable the reader to make other useful comparisons and deductions.

Although tall fescue is coarser than meadow fescue, stock seem to like it as well, and it is equally good for pasture, green soiling or hay. It may be planted at the same times and in the same quantity as the meadow fescue. While the latter matures very large crops of seed, and is hence called fertile fescue, the former in some localities matures so few that it has been called infertile fescue. It may be multiplied by parting and setting out the roots. It grows well wherever meadow fescue does, and on wetter lands and in shade also. Both are useful in stopping washes.

3. F. DURIUSCULA, Hard Fescue, contains according to Way's analysis:

In 100 parts taken from the field,	green.	dried
Water,	69.33	——
Albuminous or flesh forming principles,	3.70	12.10
Fatty matters,	1.02	3.34
Heat producing principles, starch, sugar, gum etc.,	12.46	40.43
Woody fibre,	11.83	38.71
Mineral matter or ash,	1.66	5.42
	100.00	100.00

This grass, though much smaller than the two preceding, is also perennial, green through winter, withstands summer droughts, thrives on various soils, grows a foot or two high, and is a good pasture grass.

4. F. RUBRA, Red Fescue, one of the largest of the genus, is probably only a variety of the preceding; and though growing naturally on sandy and dry soils is said to be a better grass than some of the other species.

5. F. OVINA, Sheep's Fescue is also regarded by some as a smaller variety of the Hard, and grows from 6 to 12 inches high with many very narrow radical leaves and tufts of perennial roots. This also is a good pasture grass specially for sheep, and on dry sandy lands.

6. F. TENELLA, Small Fescue grows on dry, sandy soil from 2 to 12 inches high and is of little value.

7. F. MYURUS, grows on the same soil as the preceding 6 to 12 inches high and is about equally valuable.

8. F. LOLIACEA, Spiked Fescue, Darnel Fescue, like tall fescue, to which it is closely allied, matures few seeds. In appearance it resembles rye grass, to which, Loudon says, "it is considered superior either for hay or permanent pasture, and it improves in proportion to its age, which is the reverse of what takes place with the rye grass." On rich, moist meadow it is a good pasture grass.

9. F. NUTANS, Nodding Fescue grows two to four feet high in rich as well as rocky woods and banks, with a one-sided panicle nodding when ripe. This and some others of this genus are well suited for woods pastures, where they could be mixed with Kentucky blue grass, tall oat grass, Terrell grass etc. In some localities in the southern States, meadow fescue is now beginning very improperly to be called English blue grass.

Bromus.

1. B. UNIOLOIDES, Rescue grass.

This grass is called also, B. SCHRADERI, B. WILLDENOWII, CERATOCHLOA UNIOLOIDES, and FESTUCA UNIOLOIDES. It is an annual winter grass. It varies in the time of starting growth. I have seen it ready for mowing the first of October and furnish frequent cuttings till April. Again; it may not start before January, nor be ready to cut till February. This depends upon the moisture and depression of temperature of the fall, the seeds germinating only at a low temperature. When once started, its growth after the successive cuttings or grazings is very rapid. It is tender, very sweet and stock eat it greedily. It makes also a good hay. It produces an immense quantity of leaves. On loose soil some of it may be pulled up by animals grazing it.

The quantity of sugar and oil it contains, as shown by the following analysis of Mr. Collier, specially commends it for winter feeding.

Oil,	2.99	Amylaceous cellulose,	23.74
Wax,	.24	Alkali extract,	13.13
Sugars,	14.36	Albuminoids,	12.45
Gum and dextrin,	1.00	Ash,	7.78
Cellulose,	24.31		
			100.00

ANALYSIS OF ASH.

Potassium,	16.38	Sulphuric acid,	5.61
Potassium oxide,	37.20	Phosphoric acid,	8.79
Sodium,	1.27	Silicic acid,	4.84
Sodium oxide,	——	Chlorine,	16.84
Calcium oxide,	4.43		
Magnesium oxide,	4.64		100.00

The large quantity of Potassium and its oxide and chlorine in the ash is very remarkable.

A writer in the Rural Carolinian, (vol. I. p. 604.), says Mr. Iverson introduced this grass into Georgia many years ago, adding: "I sowed it on a peach orchard, contiguous to my barnyard, a pretty rich clay soil and kept in good heart by the droppings of animals. Here for many years, it has furnished fine grazing in winter, for hogs, horses, calves etc. In the spring the stock has been taken off, and the grass allowed to drop its seed. Occasionally I have plowed it up, and I believe the better plan would be to plow it up every spring after the seeds drop, and sow down in peas. It might be made to answer a valuable purpose."

In the Department of Agriculture, Report for 1878, p. 170, Mr. Williams of Texas writes: "Inasmuch as western Texas is the great stock producing section of the South-west, and considering the fact that pasturage is scanty, particularly in February, stunting the growth of young cattle, this seems wonderfully adapted to supply just what is greatly wanted, both for milch cows, calves, colts, and ewes just dropping lambs; and besides, this grass grows well on the thinnest soil and crowds out weeds, maturing in March and early April, while not interfering with the native *mesquite*. I therefore regard this grass as a wonderful and most important discovery."

For the reasons named by Mr. Williams this grass is valuable in portions of Louisana, Mississippi, Alabama and Georgia. It is specially valuable for fall colts and their dams.

I have seen it bloom as early as November when the season has favored and no grazing or cutting permitted. Oftener it makes little start till January. But whether late or early starting, it may be grazed or mowed frequently, until April. It

will still mature seed. It has become naturalized in limited portions of Texas, Louisiana, Mississippi, Alabama and perhaps other States. It is a very pretty grass in all its stages; but especially when the culms two or three feet high are gracefully bending with the weight of the diffuse panicle with its many pedicelled, flattened spikelets, each an inch or more long and with twelve to sixteen flowers.

I would not, however, advise sowing this grass on poor land with the expectation of getting a remunerative return. It tillers abundantly under favorable conditions.

2. B. CARINATUS, California Brome Grass, according to Mr. Collier's analyses annexed, is much less nutritious than the preceding species: oil, 2.46; wax, .24; sugars, 9.38; gum and dextrin, 4.56; cellulose, 26.90; amylaceous cellulose, 17.02; alkali extract, 19.15; albuminoids, 9.88; ash, 10.31, in 100 parts. Little is yet known of it.

3. B. SECALINUS, Cheat or Chess. This well known pest in grain fields had some thirty years ago an infamous notoriety under the name of Willard's grass. With lip and pen the virtues of this grass were so adroitly inculcated that the bold *Cheat* succeeded in selling at fabulous prices his maddening *chess*, at the same time exacting a pledge from purchasers that it should not be allowed to go to seed; thus hoping to escape exposure of the fraud, and to reap alone the rewards of his ingenuity. Though not desirable on a farm, it has considerable value as a winter grass.

4. B. RACEMOSUS, Upright Chess, or Smooth Brome Grass, and 5. B. MOLLIS, Soft Chess or Soft Brome, also are found in grain fields. The seeds of these three species have been a source of great annoyance to farmers, by getting among the wheat and being ground to the serious damage of the flour. In our lower latitudes, sown alone on good soils, they make a large quantity of very inferior forage. If covered some depth in the ground, the seeds remain sound for years, and, when brought near the surface by the plow, promptly germinate and mature another crop. The growth of these species therefore should not be encouraged on our lands.

6. B. CILIATUS, Fringed Brome Grass and the variety *purgans* are found in old fields and along rich river banks and wooded hills, with stems from two to four feet high. It is one of the least valuable.

7. B. KALMII, Wild Chess, indigenous to some of our States, and growing two or three feet high, in dry woods, may offer some promise to intelligent experiment. Other species common in Europe are not known here.

UNIOLA.

1. U. LATIFOLIA, Wild Fescue Grass, Broad-leaved Spiked Grass. This beautiful grass is found on the banks of streams. The culms, two or three feet high, bear loose drooping panicles, with large, broad, flat compressed spikelets of ten to fifteen flowers. It blooms from May till August. It is perennial and in some localities is sufficiently abundant to be cut for hay. I have seen it cultivated in but one place; with what result I am not informed. As it was sown on poor hills, it certainly could not yield much hay. And on lands where it might be profitable to cultivate it, many other grasses would be more profitable. A local name for it in Mississippi is, I believe, 'wild oats.' Mr. Collier's

ANALYSIS OF UNIOLA LATIFOLIA.

Oil,	3.23	Amylaceous cellulose,	10.23
Wax,		Alkali extract,	14.40
Sugars,	6.78	Albuminoids,	11.29
Gum and dextrin,	4.02	Ash,	11.38
Cellulose,	38.67		
			100.00

ANALYSIS OF ASH.

Potassium,	5.19	Sulphuric acid,	2.62
Potassium oxide,	5.52	Chlorine,	4.71
Magnesium oxide,	3.02	Silica,	66.87
Calcium oxide,	7.15		
Phosphoric acid,	4.92		100.00

A clump of this native grass set in the flower garden would be much more attractive than hundreds of other plants imported and sold at high prices.

2. U. PANICULATA, Spike Grass, growing from two to eight feet high among the sands along the coast, has, like the preceding, long-pedicelled, drooping spikelets. It is a pretty but worthless plant for forage,

3. U. GRACILIS, Slender Spike Grass, found in rich, damp soils, with slender stems two to four feet long, flowering in July and August; and

4. U. NITIDA, Shining Spike Grass, found in swamps, with slender stems one or two feet high, have stemless or nearly sessile spikelets and are of little feeding value apparently.

PHRAGMITES.

P. COMMUNIS, Common Reed Grass.

This is one of the largest grasses in the United States, growing from five to twelve feet high with numerous leaves one or

two inches wide. The stems dying down in the fall, the perennial roots send up in the spring a large growth of stems and leaves. These while tender, the cattle eat, but quit as the plants become harder; leaving them to perfect their large terminal panicles and load them with the large seeds for feeding the winter swarms of geese, ducks and other birds.

This grass is found in swamps, along marshy streams and borders of ponds. It is found in both hemispheres. In Great Britain it is used for thatch, and is preferred to slate; being warmer in winter and cooler in summer. It might be used for the same purpose in this country; but owing to difference of climatic influences, it would not probably last here as in England for eighty years.

Arundinaria.

1. A. gigantea, or macrosperma. Large Cane.

This largest of our grasses has a hard, woody stem from one half to three inches in diameter, and ten to forty feet high, erect rounded, tapering from near the base, jointed every eight to twelve inches for one half the length or more, then joints becoming shorter and smaller to the top; leaves one to two inches wide, persistent, on clustered spreading branches, which also are jointed and appear the second year. On rich land, in the spring, the young stems shoot up full size, ten or twenty feet high and are crisp as asparagus; and by some persons as much relished. The stems would probably make nice pickles also and various kinds of preserves by adding suitable flavors to the syrup.

Hogs, cattle and other animals are fond of the young plants and seeds. Turkies and other birds and many other animals fatten on the seeds where abundant. The age at which this large cane blooms has not been definitely decided. It probably varies with the latitude, soil and surroundings, from ten to thirty years. When the seeds mature the cane dies. Grazing animals feed greedily on the leaves in winter, and find protection from the driving rains and piercing winds under the dense roof of the cane-brake or thicket. The stems are used for fishing rods, scaffolds for drying cotton, with the joints punched out for blowguns and water pipes, pieces for pipe-stems and pipes, and splits for baskets, mats and other purposes.

2. A. tecta, Small Cane. Some hold that this is the switch cane and that it is a seedling of the preceding. Its habits are different, however, from those of the large cane. It blooms sometimes two or more consecutive years without dying down to the root. Live stock like it as well as the large cane. Both grow best on rich lands, hills or bottoms; but they will grow on thin clay soil, improve it and, if protected from stock rapidly extend by sending out long roots with buds.

TRITICUM.

T. VULGARE, Wheat.

This is little used for grazing, or hay. The straw, however, is used for foddering stock and contains 2 per cent albuminoids, 30.2 carbohydrates and 1.5 fat. The chaff contains of albuminoids 4.5, carbohydrates 33.2, fat 1.4. Wheat straw, therefore, contains considerable nourishment; but less than oat straw. All know the value of wheat bran, shorts etc., as stock feed. For a number of years I sowed wheat for winter pasture with moderately remunerative results. For that purpose, I found oats, rye and barley better. Bread grains as such do not come in the plan of this work, and I therefore add in this connection only that the wheats used for human foods are annuals. Many persons believe that pigs are killed by grazing on wheat.

2. T. REPENS, Couch, Quitch, Twitch, Chandler, Dog Grass and many other names. This is perennial with stem two or two and a half feet high, so much like wheat as to be called also wheat grass. Cattle eat it heartily when green; and cut early it makes a good hay. But it fills the ground with roots, is as difficult to cultivate amongst and exterminate as coco or nut grass; and hogs are as fond of, and root up the ground as industriously to obtain the roots. Cows and horses also are fond of them. It should be destroyed as soon as found in cultivated grounds, but it is very valuable in permanent pastures.

3. T. CANINUM, Bearded Wheat Grass, of our northern States is comparatively harmless and not likely to trouble southern farmers. And

4. T. COMPOSITUM, Egyptian Wheat, is only a cultivated garden curiosity.

SECALE.

S. CEREALE, Rye. Of the four prominent species of rye, this is the only one cultivated in this country. It occupies a place intermediate between barley and wheat; and it is not always readily distinguished by the inexperienced from them, especially from wheat. But the barley spikelet has but one perfect flower, that of rye two, and that of wheat three or more: and there are other differences. Rye has a long, slender stem, bearing a terminal, erect long-bearded spike from two to four inches long.

Two varieties of rye have been produced by cultivation, winter and spring rye. The former may be be planted in fall or spring, indeed in almost any month of the year. It may be planted in late corn and plowed in laying by the corn; or it may be sown in cotton and plowed in the last working, thus cheaply

preparing winter and spring pasture; or the ground may be prepared as for wheat, or oats, the rye planted from August to December. But as it is sown in the south almost exclusively for winter pasture, the earlier it can be put in the better, provided it is not so early as to joint before it can be pastured. A bushel and a half per acre should give a good catch: if planted early and the ground in good condition a bushel may do.

It grows well on any good, well drained soil, but requires less clay and moisture than wheat or barley, and more sand and potash. My objections to it as a grazing plant are stated in treating of barley.

Rye yields a light crop of grain but it is very nutritious. The straw is hard and almost worthless for fodder. But it is worth ten or fifteen dollars a ton to the manufacturers of hats, bonnets, paper, mats and many other articles. To be very valuable, however, for most manufactures, a special machine, invented for the purpose, must be used in threshing it so as to keep the straw straight and unbroken.

In Europe, rye and wheat are often sown together, producing the mixture called *méslin*, from which the most wholesome of all breads is made. Rye may be grown longer on the same land than most other crops.

When seeding, if the season be wet, it is very liable to a fungoid disease, producing what is called ergot, the grain assuming somewhat the shape of a cock's spur and hence called spurred rye. These spurs are filled with a dark mass having the odor of spoiled fish. It is very dangerous to people and animals eating it, causing gangrene and death. Yet it contains several valuable medicinal principles; by the use of which, separated from the poisonous elements, many valuable lives are daily saved.

Hordeum.

1. H. pratense, Wild Barley, Squirrel-tail Grass.

Only a few years ago, I noticed an occasional specimen of this plant in several parts of Mississippi. Next year many acres were densely covered with it. It appears in the latter part of winter and spring, growing from six to ten inches high, sometimes eighteen, with few leaves. Cured for hay it contains according to Knop: water 14.3, albuminoids 9.6, carbohydrates 42.0 and fat 2.0; a fair quantity of nutritive matter. But the plant is so small and light as to be unworthy of attention as a cultivated crop. Stock relish it.

2. H. pusillum, Barley Grass also is small, growing six to twelve inches high. Cattle relish this grass and it is nutritious; but the product is too small to justify cultivation.

3. H. jubatum, another Squirrel-tail Grass, widely diffused through our northern States in marshes and moist sands near

seas and lakes, and in moist prairies, has not yet found its way to the more southern States. These three grasses all look much like the cultivated barley.

4. H. VULGARE, Common Barley, is one of the first grains used for human food, being mentioned in the oldest records extant. It adapts itself with wonderful facility to all climates, maturing equally in the heat of the torrid, and cold of the frigid zones. It is to be treated here only as a forage plant, and two varieties only need be mentioned. The common six-rowed variety is largely planted in this country, both in the latter part of summer, early fall and spring. Originally a spring barley, it became inured to winter. The rows are not perfectly regular, the alternate rows being less prominent. This, however, is not what is called the true winter barley, square barley, or *Hordeum hexastichum*. The common barley produces more grain, but the grains are not quite so large as those of the Two-rowed barley, *Hordeum distichum*. The difference in the yield of the two, however, is not very great, and both may be sown in our more southern States either in fall or spring.

There is no four-rowed barley as sometimes stated and as might be supposed by not examining carefully. The ear or head of barley is what is called a spike. At each joint of the spike are three spikelets, each with a fertile flower, in the common barley. As these triple spikelets alternate, when the seeds mature, the head becomes rounded and there appear six, more or less pefect, rows of grain. In the two-rowed kind, only one spikelet at each joint of the rachis has a perfect flower; the other two spikelets being reduced to sterile rudiments. The spike is longer, however, and the grain having more room is a little larger than the six-rowed kind.

I have planted barley almost solely for winter pasture, the grain being a secondary consideration; and I cannot say that any thing has given me more satisfaction. I have tried it repeatedly, in the same fields and under all the same conditions as nearly as possible, with all the other small grains; and it invariably gave far better results. I think that on my lands one acre of barley affords as much green food during the winter as the combined product of one acre each of wheat, oats and rye. When grazed down, it grows again very soon, so that it may be grazed two or three times to once with the others. It makes larger and more dense foliage and is greatly preferred by animals to the others. I think the barley decidedly more wholesome also than the others. This is not due probably to the chemical composition of the barley, but to its being cleaner. The foliage stands up and hence does not become so bespattered with clay, sand and other injurious matters as that of other small grains. With the latter much filth is eaten, especially with rye. The leaf of this lies so closely on the ground, that in

grazing it, animals receive so much sand and other dirt that their teeth and stomachs are damaged many times and the nutritive function seriously obstructed.

Barley seems not to be damaged, but rather benefitted by winter grazing; and with me it has never shown any sign of rust or other diseases, while all the other grains around it have been utterly destroyed by rust. Possibly my lands may be specially adapted to it.

Preferably I plant in September; but everything favoring, a few days earlier would not be objectionable. The quantity of seed per acre should be two and a half or three bushels. It succeeds well on almost any well drained land that has not been exhausted. On good land the crop should be forty to sixty bushels of seed per acre.

The proportions of nutritive principles in barley straw are as nearly identical with those in wheat straw, as would probably be found in two samples of the latter taken from the same mow. Now 100 pounds of barley, clean grain, contains twelve ounces more nutritive matter than 100 of clean corn. But the nutritive matters are differently proportioned and combined in the two kinds of grain. The barley I think more wholesome for animals, especially growing animals. Arab horses in their native country are fed almost wholly on barley. Many pages might be quoted to show how highly it is prized in foreign countries as a forage plant and the most gratifying results from its use in that way. I think it has given as good results in this country whenever tried. I prefer it to corn not only for young stock, but for working animals, especially in warm weather.

When harvesting barley, a portion should be left standing in the field for the hogs. It carries them through the hot months in most admirable condition. It is, indeed, a most wholesome food for them at all times, and the flesh of pigs fed with it has a peculiar tenderness, delicacy and sweetness, that induce the connoisseur to pay an extra price for it. It is said that barley-fed meat increases also in bulk when boiled. But because barley is used for raising bread and beer, it must not be supposed to have the same effect on boiling meat. The improvement must be made in the live meat.

Barley is a good food for all farm stock, including poultry; but specially as part feed for milk cows.

It can be grown cheaper than corn, heavier crops are made per acre, the crop is less liable to accidents in growth, and when harvested worth more for home consumption or as a money crop. But it requires nice care in harvesting. It should be cut as soon as fully ripe, tied in small bundles and dried thoroughly and as soon as practicable. The long beards and abundant chaff catch and hold much water from dew and rains and thus the grain is very liable to be injured. It should be thresh-

ed as soon as may be, spread in airy rooms and frequently stirred till fully dry. In threshing the machine should be run slow and the pins not so close as for wheat. This is to avoid breaking off the germ, (which is very easily done,) as this would render the grain worthless either for seed or for brewing. It is altogether safer for these purposes to thresh by hand. Seed wheat also should be threshed by hand as the machine breaks a large per centage of the grains, destroying the germs.

ELYMUS.

1. F. VIRGINICUS, Wild Rye, Terrell Grass, Virginia Lyme Grass.

This perennial grass is a native of the southern States. As all farm stock except hogs are fond of it and it is green through the winter and spring, it has been destroyed when grazing animals have access to it at all times. It is, however, found in many of our States along the banks of wooded streams, of ditches, and in fence corners, among briers and thickets. It is readily propagated by sowing the seed, (two bushels per acre,) or by separating and setting out the plants from November till April. It will grow on thin clay, gravelly, or sandy soil; but much better on rich lands—hills, bottoms or alluvials—dry or rather moist—on a great variety of soils; in open or wooded land, and will thrive ten, twenty or more years on the same land. It grows two to four feet high and matures seeds in July and August, the spikes being erect, rigid, dense, three inches long.

2. E. STRIATUS, Dennett Grass, Slender Hairy Lyme Grass.

This also is perennial and a native of the southern States. Every thing said of the preceding applies with equal force to this, except the spikes of this are three to seven inches long and often slightly nodding. In the eastern States it is small and of little value. But in the extreme south it is larger and more valuable. During the last month I have found it in seed in its native haunts in many localities—nowhere less than three or four feet high. Cultivation improves both this and the preceding so that they sometimes grow five feet high.

The spike of the Dennett grass is raised by its long peduncle far above the sheath of the upper leaf, while the spike of the Terrell grass is partly included in the upper sheath. The latter is the better of the two.

They may be grazed or mown repeatedly during spring and early summer, and grow rapidly after each mowing. Where cultivated if not mowed or grazed, they bloom and mature seed earlier, than in the wild state. Many acres have been planted in the last few years; generally those who have tried a little have been encouraged to extend it to a few acres and some to many acres.

As hay it is rather hard unless cut while young. It should be cut as soon as the blooms appear or earlier. It would be preferable to have these grasses for grazing or green soiling, and to sow better grasses for hay.

By setting the plants in the spring two feet each way on prepared land and cultivating; in the fall, the seed that drop and germinate and the tillers will cover the ground with a good winter pasture. If it shows any sign of exhaustion manure and scarify, or plow solid in fall or winter and harrow. It will soon be in full growth.

3. E. CANADENSIS, Canada Lyme Grass.

This perennial is probably not found native in any of the southern tier of States. It is about equal in value to either of the two preceding.

Siberian Lyme Grass and *Soft Lyme Grass* are not found in the southern States.

4. E. ARENARIUS, Upright Sea Lyme Grass belongs to Europe. Sir Humphrey Davy analysing the soluble matter afforded by this grass found that it contained a large proportion of sugar, besides other nutritious matters. But it is too hard to make a desirable grass for stock; though much used mixed with other grasses chopped for winter feed for cattle, in Holland and other places. It was introduced into this country by the Patent Office many years ago and planted at a number of places. But its principle use in this as in other countries is the same as that of beach grass, to bind drifting sands and prevent encroachments of the waves. Its long, creeping, perennial roots well fit it for this purpose.

Gymnostichum.

G. HYSTRIX. Bottle-brush grass differs little from the Lyme Grasses, except in the absence of glumes. It is a native, perennial, and a good forage plant. The spike, three to six inches long, when ripe resembles a bottle brush. The grass makes a stem two to four feet high and is found along the shaded banks of streams and moist rocky woodlands.

Lolium.

1. L. PERENNE, English, or Perennial Rye Grass.

This is the first grass cultivated in England, over two centuries ago, and at a still more remote period in France. It was long more widely known and cultivated than any other grass, became adapted to a great variety of soils and conditions, and a vast number (seventy or more) varieties produced; some of which were greatly improved, while others were inferior and became annuals. Introduced into the United States in the first

quarter of the current century, it has never become very popular, although shown by the subjoined analyses of Way not to be deficient in nutritive matter. In 100 parts of the dried grass cut in bloom were albuminoids 11.85, fatty matters 3.17, heat producing principles 42.24, woody fibre 35.20, ash 7.54. The more recent analysis of Wolff and Knop, allowing for water, gives rather more nutritive matter than this.

It grows rapidly and yields heavy crops of seed, makes good grazing and good hay. But as with all the Rye grasses, to make good hay it must be cut before passing the blossom stage, as after that it deteriorates rapidly. The roots being short, it does not bear drought well and exhausts the soil, dying out in a few years. In these respects it is liable to the same objections as timothy. The stem one to two feet high, has four to six purplish joints and as many dark green leaves. The flexuous spiked panicle bearing the distant spikelets, one in each bend.

It should be sown in August or September, at the rate of twenty-five or thirty pounds or one bushel seed per acre.

2. L. ITALICUM, Italian Rye Grass.

This grass grows two or three feet high and has a broader leaf than the preceding. The spikelets are arranged on the main stem as in the preceding; but differ in the florets having slender awns, giving each spikelet the appearance of a small brush. The leaves are very dark green with a metalic glint; and a field, well set with this grass undulating under wind and sun, presents the most delightfully beautiful appearance I have ever seen in the way of grasses and green fields.

All the grass eating animals are very fond of it green or cured. It is highly esteemed and cultivated in European countries and is becoming better known in America. Like the preceding, it is adapted to many latitudes, soils and conditions. Sown from August to October, twenty or thirty pounds of seed per acre, it affords good winter and spring pasture. But being an annual it must be reseeded every year, unless seed are allowed to mature and fall. It may be mowed very early in the spring, sometimes in the winter as early as December, and from five to ten times between April and November.

On rich lands no other grass will probably bear so many mowings, nor is any other better adapted to green soiling. It is a ravenous feeder and thrives on the richest soils and many applications per year of rich fertilizers. But the enormous yield of delicious forage amply repays the expense of such feeding, in the sleek coats and distended sides of the happy colts, horses, sheep and cattle, the improved health of the animals, the big pails brimming with rich delicious milk and the well-filled tubs of beautiful, fine flavored butter.

In the darying districts of Europe, where irrigation is employed, the quantity of forage afforded by this grass is simply

enormous. But to obtain the best results, it must be abundantly fertilized. This grass stands drought well and grows most luxuriantly in our southern States. If not kept grazed or mowed, however, the leaves cover the ground so deeply and densely, that an excess of rain in very hot weather in the extreme south causes it to rot suddenly, destroying even the roots. This I have never seen or heard mentioned by any other person. But it occurred on my own farm one season where I was reserving a lot for seed.

Way's analysis of this grass taken green from the field shows 100 parts to contain: water 75.61, albuminoids 2.45, fatty matters .80, heat producing principles 14.14, woody fibre 4.82, ash 2.21: or about 17.36 nutritive matters. This at first blush looks little it is true, and less when compared as is usually done with timothy cut and analysed in the same condition, the latter containing 29.21 of nutritive matters and 57.21 water; or 18.40 per cent less water and 11.85 more nutritive matters. In the dried state, Way's analyses show that the Italian Rye grass contained 71.19 per cent of nutritive matter and timothy only 68.26. Animals are very fond of it for grazing, green soiling, or as hay; selecting it among other grasses. They are usually the best judges of what is adapted to their own conditions and the needs of their systems. And the effects this grass produces on their general condition and upon the products of the dairy confirm the judgement of the cows. Now it is true that cut and fed green Italian Rye grass contains much more water than timothy. The cow decides that this is no disadvantage, as in consequence she has to go seldomer to and take less water from the pool. It is mixed intimately in the grass ready for her use. The grass is tenderer, more easily masticated and digested and the nutrition more completely assimilated, thus reducing waste of muscular and nerve tissue and heat producing principles. The total crop of timothy for the year is besides small compared with that of the Italian rye grass to the acre; and but two cuttings at most of timothy may be had, while the latter may be cut many times.

3. L. annuum, Annual Rye Grass, according to Way's analysis, contains in 100 parts, green: water 69.00, albuminoids 2.96, fatty matters .69, heat producing principles 12.89, woody fibre 12.47, ash 1.99. Some have fancied this variety because it produces taller stems and more of them than some of the others. But the proportion of foliage is less and the hay inferior.

4. L. arvense found in the south is a worthless species with small stems only from six to twelve inches high.

5. L. temulentum, Poison Rye Grass. This pernicious weed is sometimes found in grain fields growing two feet high with the characteristic flexuous spikelet bearing stem about a foot long. It is very injurious to people or animals eating it

with grain or in bread made from flour contaminated with it. Hence the wisdom in selecting this weed in constructing the parable in Matthew XIII, 25—36; it being the darnel or tares there mentioned and almost the only cereal possessing, when sound, injurious properties. It may be distinguised from other species by the very long glumes equalling the spikelets in length.

It is the Zizania of the parable, transferred into the Latin Vulgate, the Italian, Spanish and some other versons; translated Ivraie in the French and *Darnel* in most English versions, but unfortunately 'tares' in King James' version. The tare, vetch, or any other bean could, as soon as sprouted, be recognized as not at all like wheat. But this plant, even in the spike, resembles wheat, and hence the force of the parable. It is probably the *infelix lolium* of Virgil.

6. L. MULTIFLORUM, Many flowered Darnel is very handsome and showy, but not much cultivated or esteemed any where.

AIRA.

1. A. FLEXUOSA, Wood Hair Grass.

This perennial plant grows one or two feet high on rocky hills and mountains and sandy soils, but not on clays. Cattle and sheep eat it, but it produces very little nourishment to the acre. It is really not worth cultivating for feed, but affords a pretty addition to bouquets.

2. A. CÆSPITOSA, Tufted Hair Grass.

Grows in clumps or tufts in tough marshy lands, preferably where water stands much of the time, but is occasionally found in pastures or meadows. It is worthless.

The other species are not found in the southern States.

DANTHONIA.

1. D. SPICATA, Wild Oat Grass, Old Fog, White Top.

This is a native perennial growing on dry, barren soils with a slender stem ten to eighteen inches high bearing a few spikelets.

2. D. SERICEA, Taller Wild Oat Grass, also a native, grows on dry or moist sandy soils, with stem two feet high bearing many spikelets. These are grasses of little value.

TRISETUM.

1. T. PALUSTRE, Marsh Oat Grass.

This is found in swamps, and has a feeble stem one or two feet high with a long narrow panicle.

2. T. MOLLE, Downy Persoon, with a stem six or eight inches long is found on rocky banks and mountains. Both these grasses are perennial, but have no agricultural value.

3. T. PUBESCENS, Downy Oat Grass is a valuable forage plant, but has not been introduced in the south.

Avena.

1. A. PRATENSIS, Meadow Oat Grass.

This is a perennial native of Great Britain, where it grows about eighteen inches high in pastures. It flourishes best on dry soils and yields a medium quality of hay. As some of our recent writers have evidently confounded this with the *Tall Meadow Oat Grass* (described on another page) and have given it qualities that belong to the latter, it is well to give a rather minute description. "Spikelets three to many flowered, with an open, large, diffused panicle; lower pale seven to eleven nerved, with a long, usually twisted awn on the back; stamens three; grain oblong, grooved on the side, usually hairy and free."—Flint. Any, who purchase and plant seeds of this grass with the expectation of obtaining the large winter grazing, soiling, hay and seed crops of which they may have read, will assuredly reap a large harvest of disappointment and vexation. Mr. Howard, in his pamphlet, gives an excellent account of *Tall* Meadow Oat Grass, but unfortunately calling it Meadow Oat Grass, has no doubt inadvertently misled other writers into some singular errors.

2. A. FLAVESCENS, Yellow Oat Grass,

This perennial is a native of France and grows naturally on light, dry soils. By some farmers in many parts of the world, it is regarded, as a hay and pasture grass, the most useful of this genus. It has been tried in this country to only a limited extent. Way's analysis of it shows in 100 parts of the dried grass: albuminoids 7.48, fatty matters 2.61, heat producers 47.08, woody fibre 35.95, ash 6.88. It is much better mixed for pasture than for other purposes, its unusually large quantity of bitter extractive matter rendering it specially grateful to cattle.

3. A. STRIATA, The Purple Wild Oat of our northern States is of little worth; and

4. A. PRÆCOX, Early Wild Oat, found in the northern tier of the southern States is a dwarf, three or four inches high and merits no further attention.

5. A. SATIVA, Common Oat.

This is well known every where and has always been a favorite crop with me, both for winter pasture, hay and grain. The 'red rust proof' variety is preferred to all others, the potato oat being my second choice. The former has never rusted with me. The latter has not been sufficiently tested to be assured against

rust. The oat is so well known that no discussion of it is needed here. It is much superior to Indian corn for feeding horses and mules. I could not be induced to feed my own stock mainly on Indian corn. The horse fed with oats has more elasticity, spirit and bottom, lasts much longer and is capable of more prolonged exertion. I consider three bushels (96 pounds) of oats equivalent to two bushels (112 pounds) corn for horse food, with many advantages over the latter.

ARRHENATHERUM.

A. AVENACEUM, Tall Oat Grass.

This is called also *Tall meadow oat grass*, Evergreen grass in Virginia and other southern States, and it is the Tall oat (Avena elatior) of Linnæus. It is closely related to the common oats and has a beautiful open panicle, leaning slightly to one side. "Spikelets two-flowered and a rudiment of a third, open; lowest flower staminate or sterile, with a long bent awn below the middle of the back."—Flint.

It is widely naturalized and well adapted to a great variety of soils. On sandy, or gravelly soils it succeeds admirably, growing two or three feet high. On rich dry upland it grows from five to seven feet high. It has an abundance of perennial, long fibrous roots penetrating deeply in the soil, being therefore less affected by drought or cold, and enabled to yield a large quantity of foliage, winter and summer. These advantages render it one of the very best grasses for the south both for grazing, being evergreen, and for hay, admitting of being cut twice a year. It is probably the best winter grass that can be obtained. It stands high in nutritive principles as will be seen by

WAY'S ANALYSIS.

	Green.	Dry.
Water,	72.65	
Albuminoids or flesh forming principles,	3.54	12.95
Fatty matter,	.87	3.19
Heat producing principles,	11.21	38..03
Woody fibre,	9.37	34.24
Mineral matter, or ash,	2.36	11.59
	100.00	100.00

It will make twice as much hay as timothy and containing a greater quantity albuminoids, and less of heat producing principles, it is better adapted to the uses of the southern farmer, while it exhausts the surface soil less and may be grazed indefinitely except after mowing. To make good hay it must be cut the instant it blooms and, after cut, must not be wet by dew or rain which damages it greatly in quality and appearance.

For green soiling it may be cut four or five times with favorable seasons. In from six to ten days after blooming the seeds begin to ripen and fall, the upper ones first. It is therefore a little troublesome to save the seed. As soon as those at the top of the panicle ripen sufficiently to begin to drop, the heads should be cut off and dried, when the seeds will all thresh out readily and be matured. After the seeds are ripe and taken off the long abundant leaves and stems are still green and, being mowed make good hay.

It may be sown in March or April and mowed the same season; but for heavier yield it is better to sow in September or October. Along the more southerly belt from the 31° parallel southward it may be sown in November and onward till the middle of December. Whenever sown it is one of the most certain grasses to have a good catch. Not less than 2 bushels (14 pounds) per acre should be sown. Like timothy, on inhospitable soils, the root may sometimes become bulbous. The average annual nutrition yielded by this grass in the southern belt is probably twice as great as in Pennsylvania and other northern States.

HOLCUS.

1. H. LANATUS, Velvet Grass, Meadow Soft Grass.

In the eastern States this grass is called Salem Grass and White Timothy; in the south Velvet Lawn Grass and Velvet Mesquit Grass; in England Woolly Soft Grass and Yorkshire White; on the continent it has three French, two German, one each Dutch, Danish and Swedish names. Yet it has been sent to me for name, from many places in many States and more frequently than any other grass. Having found its way to Texas, how long ago would perhaps be difficult to ascertain, people going there from the older States have sent back seeds to their friends calling it Texas Velvet Mesquit Grass, supposing that it is a native of that State. So far as has come to my knowledge nine-tenths of all the so called Mesquit grass planted in the southern States is this same European Velvet Grass.

This grass is so beautiful and different from all others as to arrest the prompt attention of the most listless person. It grows much larger in some of the southern States than in the eastern or in England; and it seems, too, to be more valuable here. It grows two to four feet high here with compound panicle variously tinted-frosty, pale, greenish, pinkish, reddish etc. The leaves, sheaths and joints are covered with soft downy hairs, giving the plant the touch and appearance of the softest velvet. With a moderate magnifying power it will be seen that the stem, sheaths, leaves and branches of the panicle are marked by longitudinal striæ, green and white, the latter being

the narrower. It is the mingled tints of these stripes that give the peculiar shade to this grass.

Velvet grass may be readily propagated by sowing the seed or by dividing and setting the roots; and it will grow on almost any land however poor. It luxuriates in moist peaty lands, but will grow on poor sandy or clay hill lands and produce remunerative crops where few other plants will make any thing. It has been cultivated in North Carolina on such land and, after cutting and allowed to grow again, plowed under with so much advantage that other crops were subsequently produced. Hon. H. W. L. Lewis of Louisiana has cultivated this grass many years with great satisfaction. He tried it various ways. One, which he approves, is to prepare the ground well and sow turnips in rows two and a half feet apart in July or August. When up thin to six or eight inches, cultivate once or twice and sow the grass seed broadcast and brush in. Little or nothing is seen of the grass till the turnip crop is taken off; then the first warm days in January and February give the grass a rapid growth. From that time a part is cut daily for the cattle and work horses, one acre affording an abundant daily feed for six horses till oats are ready to cut. Then, ceasing to cut, it matures five or six bushels of seed.

According to Way's analysis 100 parts of velvet grass dried at 212° F. yielded: albuminoids 11.52, fatty matters 3.56, heating principles 39.25, woody fibre 39.30, ash 6.37; showing that in flesh and fat forming principles it surpasses timothy slightly, though not equaling it in heat producers. Yet some of our northern as well as English farmers tell us it is an inferior grass, not relished by cattle etc. This cannot be because of any lack in quantity of nutritive matters as shown by Way's analysis. This will be still further manifest by considering Sinclair's Woburn experiments. Let us use one of the best, orchard grass, for the comparison. Cut in bloom from rich sandy soil it yielded green per acre, 27,905 pounds which dried gave 11,859 pounds, containing 1,089 pounds nutritive matters. Velvet grass, cut in bloom from stiff clay loam, yielded 19,057 pounds, which dried gave 6,661 pounds, containing 1,191 pounds nutritive matter. Of the orchard grass 64 drams gave 122 grains nutritive matter, while 64 drams of velvet grass gave 240 grains nutritive matter. The advantage seems to be all the way through in favor of velvet grass.

The reason then why cattle do not prefer it, is not because of its deficiency in nutrition, but of its combination. It is deficient simply in saline and bitter extractive matters, which cattle relish in grasses.

It is by no means the best of our grasses; but best for some lands and on such lands more profitable than other grasses. Other grasses are more profitable to me.

It should be sown from August to October, fourteen pounds, equal to two bushels, per acre. Northward it is perennial; in the south not strictly so. It seems to have been greatly improved by acclimating in Texas and other southern States and this is true of some of the other grasses and forage plants.

2. H. MOLLIS, Creeping Soft Grass.

This has a shorter, more open panicle than the preceding, but the same soft, woolly appearance. It grows on a great variety of soils, but its strong creeping roots render it undesirable where we have so many better grasses for all purposes.

Hierochloa.

H. BOREALIS, Seneca, Vanilla, or Holy Grass.

This fragrant grass has strong creeping roots and little foliage; and though cattle eat it, it is not desirable for this country.

2. H. ALPINA, Alpine Holy Grass, found in the northern States is still less valuable.

Anthoxanthum.

A. ODORATUM, Sweet-scented Vernal Grass.

This is an early spring and late fall grass, and best known of the two fragrant species. A native of Europe, it is naturalized in most of our States to some extent, planted in gardens for use in bouquets, in meadows to flavor hay and in pastures to give variety and with a view, probably erroneous, of improving the quality of milk and butter obtained from cows feeding on it. The grass rubbed in the hands imparts its aromatic odor, as it does also to hay with which it is cured. This is due to benzoic acid found in this grass, or rather to an aromatic oil associated with the acid.

Way's analysis of this grass dried at 212° F. shows in 100 parts: albuminoids 10.43, fatty matters 3.41, heat producing principles 43.48, woody fibre 36.36, ash 6.32. The proportion of nutritive matter is very considerable, but the yield per acre is small. This and the fact that cattle do not relish it alone indicate that it would be profitless sown alone. Hence it is always properly mixed with other grasses for pasture or meadow. It is perennial and hardy, and grows one or two feet high.

The palet which encloses the ripe seed has on the back a long twisted and bent awn. This gives the seed a property similar to that possessed by the "animated oat." Place the seed in the moistened hand and the awn, absorbing the moisture, is thereby made to untwist and cause the seed to move like an insect. It is by this action of the awn and palet that the seed is lifted out from the other parts of the spikelet and thus prevented from germinating before matured in wet weather.

The seeds weigh six pounds to the bushel. Two pounds should be planted in mixtures.

MILIUM.

M. EFFUSUM, Wild Millet Grass.

This foreigner has become naturalized northward, but I have not found it in the south. It grows from three to six feet high from a perennial root and has broad, flat, thin leaves, containing little nutritious matter. It is not desirable on the farm. The closely allied genus

AGROSTARIUM is found in the southern States where it is native. There are two species *A. parishii* and *A. Floridanum*, the latter a new species found by Mr. Chapman. Neither is of sufficient importance to require further mention here.

CYNOSURUS.

C. CRISTATUS, Crested Dog's Tail.

This has been introduced into this country sparingly; and though nutritious it is not much esteemed, being short and soon becoming hard. According to Way 100 parts dried contained: albuminoids 14.08, fats 3.54, heat producers 52.64, woody fibre 26.36, ash 3.38. It is good in mixture for sheep walks and lawns, ten or twelve pounds per acre of seed being required. It grows on dry, sandy, calcareous uplands.

PHALARIS.

1. P. INTERMEDIA, American, or Stewart's Canary Grass.

This is a beautiful native grass of the southern States, highly esteemed, by the few who grow it, for winter and spring grazing, soiling, and hay. The variety, (*augusta*) especially is much larger and more valuable. It grows two or three feet high, and in swamps five feet, with many leaves four to ten inches long and spike two to four inches long and somewhat resembling the head of timothy. Stock like it well especially as hay. Mr. D. Stewart of Louisiana having tested other grasses prefers this for quantity and quality for winter and spring grazing, and for soiling for milk cows. In some localities it is called Gilbert's Relief grass and in others California timothy.

There is much testimony from many parts of the south of the same import; and this grass is doubtless worthy of extended, careful testing. Never having been analysed, we have not at hand the means of estimating chemically its comparative nutritive merits. An analysis would probably, as in many other cases, verify the judgement of the intelligent farmers who have grown this grass. Being a native, it is specially desirable to

grow it with a view to improvement. As has happened with so many other plants, proper soil and culture will probably demonstrate much worth and improvement in this grass and particularly the variety.

2. P. ARUNDINACEA, Reed Canary Grass.

This coarse, rough grass growing naturally in, and about the margins of marshes, shallow lakes and streams, possesses adaptability to a variety of soils, wet and dry, and varies considerably in the coloring of foliage and flowers. On dry lands the leaves become striped forming the garden variety known as ribbon grass. The cylindrical stem from two to seven feet high bears five or six broad leaves, light green in wet places, variously striped in dry. It is a beautiful plant.

Although all the analyses I have seen show considerable, and some a large proportion of nutritious matter, cattle do not relish it well. In the Woburn experiments, one acre of black, sandy loam yielded 27,225 pounds of grass, losing in drying 14,973 pounds, and giving 1,701 pounds nutritive matter. A tenacious clay soil yielded 34,031 pounds of grass, losing in drying 17,015 pounds and giving 2,126 pounds of nutritive matter. According to Scheven and Ritthausen the dried grass showed in 100 parts: protein 6.12, fat 1.30, heat producing principles 40.63 woody fibre 43.55, and ash 8.40.

Yet it does not produce as much flesh or milk as its composition would warrant us to expect. But we should remember that when in bloom, as it was in the Woburn trials, although it contains more nutritive matter than at an earlier stage, yet it has already become hard, woody and comparatively indigestible. If utilized therefore for stock-feed, it should be cut while young and tender, only a foot or two high. It may thus be cut two or three times each summer. It should never be allowed to reach full bloom, because subject to attacks of a fungous growth similar to, or perhaps identical with spurred rye, or ergot, which is considered very fatal to cattle eating it.

This hard grass might be rendered tender and digestible by placing in *silos* or by ensilage, as now practised in France and by a few in America, with corn fodder for winter forage.

This grass may be propagated by dividing and transplanting the roots every square foot, or by sowing the seed at the rate of half bushel or twenty-five pounds per acre.

In marshy lands it weaves such strong webs of roots that it can bear up teams of oxen and loaded wagons. It retains washings, thus assisting to fill up and reclaim small marshes. It may obstruct small streams and thus produce other marshes however, which must be guarded against.

In conclusion, as we have so many better grasses for agricultural purposes, I would not recommend to cultivate this for forage.

3. P. CANARIENSIS, Common Canary Grass, partially naturalized in some localities, is pretty, and, when young, relished by cattle; but it is cultivated only for the seeds for bird-feed.

PASPALUM.

In the southern States there are twenty species of Paspalum recognized. No trivial name has been generally adopted for any of them. The name 'water grass' has been applied to one or two of them that grow not in the water but in cultivated fields; but is only of local use and not distinctive from having been longer appropriated and more generally given to several other grasses. Paspalum is more generally used; and there is no reason why it should not exclude all other names. The several species can then be designated by adding a word marking some characteristic of each.

Except two, these paspalums are all perennials. They are all succulent, tender, nutritious, hardy, thrifty and relished by all grass-eating animals. They fill the soil with a matting of roots and cover the surface densely with luxuriant foliage from early spring till autumnal frost. In some localities from this dense, rather smooth covering where grazed, they are called as if one, 'carpet grass.' But this name, also having been previously appropriated, is not distinctive. Several species are often found on the same common, arriving at maturity at different periods, and some are in perfection throughout the season.

The genus as a whole is one of the most valuable of all our native southern pasture grasses, perhaps I should add, hay grasses. For compared with three of the best known and esteemed cultivated grasses the nutritive matter they contain is in the following order: timothy 67.26, paspalum 65.85, orchard 60.99, blue grass 56.04. Although this shows timothy containing a little more nutritive matter, yet, being less digestible, it does not make so good a hay as paspalum.

Mr. Collier's analysis shows that 1. *Paspalum læve* contains in 100 parts: oil 1.74, wax 1.02, sugars 8.86, gum and dextrin 5.47, cellulose 27.72, amylaceous cellulose 26.67, alkaline extract 13.95, albuminoids 8.14, ash 6.43. The ashes were found to contain potassium oxide 25.44, sodium 1.12, sodium oxide .66, calcium oxide 9.36, magnesium oxide 5.56, sulphuric acid 5.64, phosphoric acid 6.18, silicic acid 44.65, chlorine 1.73.

Another farmer and myself have spent our lives so far in the same vicinity. He has always been widely known for the good condition in which he keeps all his animals and for liberal feeding. For twenty-five years he has been feeding this grass; and for many years has had a meadow of this grass alone, from which without ever having seeded, he annually mows about two tons of hay per acre. Drovers, who have been in the habit of

stopping with him every year, declare this hay to be unsurpassed for excellency by any hay produced in any other State.

This *Paspalum læve*, Smooth Erect Paspalum is perennial, growing naturally in dry woods, margins of fields, and open meadows, two to four feet high, with three to five slender spikes three or four inches long near the top of the simple erect stem. The leaves are rather long and broad. It grows rapidly in the cotton fields, even on poor clay and sandy hills. The seeds are large and nutritious and fall easily while apparently green, though really mature, the stems and foliage remaining green long after. It should therefore be cut before the seeds get ripe enough to fall off. It is usually cut once a year. It might be cut two or three times with much more profit.

2. P. PRÆCOX, Early Paspalum, grows in the same localities as the preceding, erect, about the same height and having three to six spikes. Its leaves are narrower and the sheaths often purplish. The seeds are in pairs arranged in three rows on the straight flattened rachis, and the glume three nerved, often discolored. The preceding has the glume with five nerves and the single seeds arranged in two rows on a flexuous rachis.

3. P. RACEMULOSUM, Stemmed Paspalum, grows also in same localities as the preceding, two or three feet high, bearing two or three erect, slender spikes four inches long; seeds single or by pairs distinctly pedicelled, distant on the filiform rachis. The leaves are long linear, glaucous, sprinkled as are the sheaths with long white hairs.

4. P. CILIATIFOLIUM, Hairy Slender Paspalum.

This is quite common both on dry and wet soils, with stems one or two feet long, often prostrate; frequently two or more peduncles rise from the upper sheath, each bearing often but one spike; leaves flat, one to three fourths of an inch wide, wavy, fringed on the edges and with the sheaths hairy all over.

5. P. DISTICHUM, Joint Grass, Twin Paspalum.

One name is from the flower stems bearing usually a pair of spikes, (which are one to one and a half inches long,) the other from its many-jointed diffuse stems creeping along the ground inserting roots at every joint. The flower bearing part of the stem rises about a foot high. This species grows as well where partly submerged as otherwise.

6. P. DIGITARIA, Finger Shaped Paspalum, has creeping, branching stem, finally rising a foot or two high; often having several elongated peduncles from the upper sheath, bearing filiform, horizontally spreading spikes three or four inches long; sheaths compressed and leaves mostly fringed on the margins. This is found in open swamps.

7. P. VAGINATUM, Sheathed Paspalum, is found in brackish swamps. The short jointed stems are diffuse, creeping, two to four feet long; the flowering branches erect, five to ten inches high; the dilated sheaths persistent.

8. P. WALTERI, Walter's Paspalum, is found in cultivated lands, prostrate, creeping, one to three feet long; spikes three to seven, the lowest included in the upper sheath. All the preceding are perennial. The next two are annuals.

9. P. FLUITANS, Floating Paspalum.

This is found in swamps; culm one to three feet long, with creeping or floating base, from which it ascends and branches, bearing numerous racemed spikes.

10. P. UNDULATUM, Purple Paspalum, grows on rich cultivated grounds one to three feet high, bearing two to twelve spreading spikes two or three inches long; the small spikelets crowded in three or four rows under the flat rachis; the usually deep green leaves and sheaths often become purple.

Two other species are found in Florida. For cultivation, the following are specially desirable: *P. læve, P. undulatum and P. ciliatifolium* for dry uplands, slants and moist or dry bottoms; *P. præcox* flourishes in the same conditions, better perhaps with more water; and *P. racemulosum* in dry, sandy soil, but will succeed well on better, moister land. They come in bloom in the following order from May to September; *P. præcox, ciliatifolium, læve, racemulosum, undulatum;* and they continue to bloom from two to four months each, making a fine succession for pasture; for which I would sow a mixture of all these.

There would be no objection to sowing several of them, or even all for mowing and the mowing should be repeated at proper intervals, allowing some seeds to mature before each mowing to ensure a full setting next year, although all these have perennial roots.

The stubble may be plowed under in the fall or in the spring, or replowed and harrowed in the spring; the latter plan perhaps insuring a better crop than leaving the land unbroken from year to year.

PANICUM.

1. P. SANGUINALE, Crab Grass.

Every planter is familiar with this widely disseminated, naturalized foreigner, which has won many a hard contest against man and beast with plow and hoe, forcing the man with wearied brain and exhausted muscle to gain his bread in the sweat of his face—with many a Thomsonian sweat forsooth from top to toe. Yet I have seen a crop (many of them,) of this grass harvested worth more than the corn that could be produced on the same ground. I have seen corn fields and cotton fields of a wet season so overrun with this grass that in May, June, July or August, ten days' work with mowers and horse-rakes would secure in choice hay two to ten fold more value, than many months' labor with teams and machinery and heavy expenses

could obtain from the cotton or corn. Mowing among corn ridges is indeed rough work. But I have seen a mower that worked admirably and cut the grass all perfectly by running across the ridges. It is impossible with any mower to do satisfactory work running with the rows.

When the corn crop is good and early matured and the grass late, the former may be harvested; and the mower may then be used as above, cutting stalks and grass; or if desirable the stalks may be first cut with hoes and removed. When I had no mowers, I found the grass scythe a valuable implement for cutting this grass. Cutting with the hoe and pulling by hand, as many do, gather too much dirt with the hay. This grass makes an excellent hay of which live stock are very fond, preferring it to the best northern hays. Mr. Collier's analysis gives, for crab grass:

Oil,	2.87	Amylaceous cellulose,	24.29
Wax,	.02	Alkali extract,	3.87
Sugars,	9.88	Albuminoids,	9.99
Gum and dextrin,	5.60	Ash,	10.68
Cellulose,	32.80		
			100.00

FOR ASH.

Potassium,	6.67	Phosphoric acid,	6.40
Potassium oxide,	33.56	Silicic acid,	30.93
Calcium oxide.	4.40	Chlorine,	6.04
Magnesium oxide,	7.98		
Sulphuric acid,	4.02		100.00

This grass varies much in size and other respects according to soil and season. Stems have been measured seven feet long; but it is usually two to four feet, and may yield one to two tons of sweet delicious hay per acre. It should be cut as soon as in bloom; and often two mowings may be made in a season.

Any good piece of ground that has had this grass matured on it the preceding year may be plowed and harrowed smoothly and then rolled in May; and it will soon be covered with a rich growth. If the season favor, two mowings should be made. For a number of years I pursued another plan also with much satisfaction. A piece of land that had matured plenty of crab grass seed was prepared and in the fall sowed with spotted medick (sometimes called yellow, burr, or California clover) for winter and spring pasture, without any thought of the grass. As usual, the medick having matured seed, died in May. Immediately crab grass came up very thick. This mowed in July and August and again in October. This process was repeated for a number of years without reseeding, or any other work than mowing the grass. The second cutting yielded not over half as

much hay as the earlier one, but it was of the choicest quality. The medick seemed to replace the elements removed by the hay crop, the last year yielding as much hay as any preceding. The medick was never mowed, but grazed from December till April; after which it covered the ground very densely, maturing seed promptly, which after removing the hay in the fall sprang up for winter pasture. This process was continued till the land was required for another purpose. See pages 3 and 4 for a fuller account.

Crab grass is excellent for summer pasture also; and with many bad managers it comes as a God-send to eke out a short corn supply for work animals, saving their lives from May to August and thus saving the growing crop.

2. P. VIRGATUM, Tall smooth Panic grass.

This is called also switch grass; and in August and September the stem attains a height of two to seven feet, being crowned with a large, diffuse, open panicle. On sandy, moist soil it thrives well, yields considerable forage and is nutritious if cut young. A number of stems rise from each clump. Its proximate principles vary considerably in different localities as is manifest from the following analyses made by Mr. Collier of samples from Texas and Alabama:

	Texas.	Alabama.
Oil,	1.25	1.75
Wax,	.45	.17
Sugars,	7.05	9.61
Gum and dextrin,	3.37	3.02
Cellulose,	37.38	28.87
Amylaceous cellulose	27.59	25.94
Alkali extract,	13.06	22.50
Albuminoids,	5.01	4.58
Ash,	4.84	3.56
	100.00	100.00

ASH ANALYSIS.

Potassium,	3.36	1.54
Potassium oxide,	18.76	22.53
Sodium,	1.22	1.74
Calcium oxide,	7.87	7.39
Magnesium oxide,	3.63	7.98
Sulphuric acid,	3.56	5.29
Phosphoric acid,	5.50	4.37
Silicic acid,	51.17	45.10
Chlorine,	4.93	4.06
	100.00	100.00

This grass is valuable on the soil mentioned above and is perennial.

3. P. filiforme, Slender Crab Grass.

This plant grows well on dry sandy soil, is about two feet high, very slender, has little foliage and is consequently of no great agricultural value although very common. Still Mr. Collier's analysis is appended :

Oil,	1.29	Amylaceous cellulose,	29.96
Wax,	.25	Alkali extract,	23.19
Sugars,	5.89	Albuminoids,	3.32
Gum ahd dextrin,	4.67	Ash,	4.65
Cellulose,	26.78		
			100.00

Ash.

Potassium,	13.41	Phosphoric acid,	6.37
Potassium oxide,	12.98	Silicic acid,	40.36
Calcium oxide,	4.69	Chlorine,	12.17
Magnesium oxide,	5.18		
Sulphuric acid,	4.84		100.00

4. P. anceps, Double-headed, Variable Panic Grass.

This perennial is very common on tenacious, damp, sterile soils, the flat stems rising from one to four feet high ; the radical leaves abundant, soon tough, eaten by cattle and horses, but not when they can get better, tenderer forage. It forms strongly rooted, spreading clumps, often completely carpeting the ground with very pretty, glossy, light green, assurgent foliage.

5. P. amarum, Bitter Panic Grass.

This perennial is very common on sandy lands, and especially about streams. It is too bitter and otherwise unpleasant to be relished by cattle and is eaten by them only when they can do no better.

6. P. capillare, Hair-stalked panic, or Old Witch Grass.

This annual grows preferably on sandy lands, but is found in old fields and poor cultivated lands all over the United States. The culms rise one or two feet high, bearing a few scattered seed on capillary wide spreading branches. The stems are fragile when dry, and the panicles are often seen floating high up in the air, landing in trees, houses, streams, ponds etc. Often the wind breaking them off where a field is covered with them, rolls them along and piles up against fences and hedges to a height of several feet ; and sometimes they fill up gullies and cuts in roads. But the branches although so slender are rigid and rough, so that they pack so loosely that one might pass through a pile of them at night almost without being aware of

its presence. This grass, especially the hairy varieties is utterly useless for cattle.

7. P. DIVERGENS, Autumn Panic grass.

This perennial is very common on dry sandy lands and old fields, growing about a foot high. Cattle eat it when they can find nothing better; but it is worth little.

8. P. VERUCCOSUM, Warty Panic Grass.

This perennial is found in swamps. The culms are from two to four feet long, very slender, smooth and branched. The glumes are rough with minute warts. This grass is worth little.

9. P. LATIFOLIUM, Broad-leaved Panic Grass.

This perennial grows twelve to eighteen inches high in moist or dry, rich wooded lands; with leaves an inch or more wide and three or four inches long. It bears repeated grazing from May onward and cattle relish it. But it grows too scattering to be profitable in cultivation.

10. P. CLANDESTINUM, Hidden-flowered Panic Grass.

This valuable perennial is similar to, and grows intermixed with the last. It is later and the stems one to three feet high, very leafy and with axillary branches; the panicles lateral and terminal, small and more or less hidden in the sheaths; the leaves one inch or more wide and three to six inches long.

11. P. PANGIFLORUM, Few-flowered Panic Grass.

This grass grows one or two feet high in swamps and bogs and is of little value.

12. P. VISCIDUM, Sticky Panic Grass.

This soft, densely velvety, downy grass grows one to four feet high in wet swamps and bogs; stems very leafy and much branched, varies very much. It is of little value.

14. P. DICHOTOMUM, Polymorphous Panic Grass.

This perennial growing in swamps, woods, fields, every sort of place from a half foot to three feet high is very variable in stems, panicles, branches, leaves, down, hairs etc. Stock eat it; but it is not very valuable.

14. P. GLABRUM, Smooth Panic Grass.

This is common in pastures and along road-sides, resembles *P. sanguinale* in general appearance, but is smaller and not hairy, nor so much relished by cattle.

15. P. OBTUSUM, Obtuse flowered Panic Grass.

This grass, found in Texas, New Mexico and South America, is described as "similar in appearance to the *P. Texanum*, but lower and less vigorous in growth, with narrower panicles, and narrower, smoother leaves." Ag. Dept., R. 1878. Mr. Collier's analysis annexed shows its nutritive value about equal to that of Texas millet.

Oil,	1.77	Amylaceous cellulose,	24.21
Wax,	.50	Alkali extract,	8.75
Sugars,	9.68	Albuminoids,	7.28
Gum and dextrin,	5.74	Ash,	8.75
Cellulose,	33.32		
			100.00

ASH.

Potassium,	4.62	Phosphoric acid,	5.18
Potassium oxide,	21.65	Silicic acid,	48.60
Calcium oxide,	5.91	Chlorine,	4.20
Magnesium oxide,	3.13		
Sulphuric acid.	6.71		100.00

16. P. PROLIFERUM, Prolific, or Sprouting Crab Grass, in favorable, moist situations, with many creeping stems rooting at the joints, throws up a large number of thick, succulent, tender, sweet, geniculate, much branched stems from three to seven feet high, with lateral and terminal, diffuse panicles. The broad leaves and panicles vary in length from six inches to two feet. It grows vigorously from mid-summer till frost; admitting several mowings and yielding a large quantity of excellent, but somewhat coarse hay, requiring, as all succulent large plants, care and time to cure well. Horses and cattle eat it ravenously at all times, green or dry. I esteem it as a very valuable grass and worthy of much attention. Although naturally preferring river and creek bottoms and even brackish marshes, yet it grows luxuriantly on hill sides and tops, and late in the fall in moist cultivated fields. Where cattle have free access to it at all times, they keep it eaten so closely as not to allow seeds to mature. It should not only be protected, but cultivated as more valuable and much more promising than many other forage plants of inferior worth now receiving great attention and care. It delights in and needs rich land, as do all very valuable forage grasses.

17. P. TEXANUM, Texas Panic Grass is perhaps the most beautiful of all the many species of Panicum. In habit it is much like crab grass, more branched, with more abundant and broader leaves—the latter ½ to 1 inch wide and six to eight inches long. The whole plant is tender, nutritious and highly relished in both green and dry state by live stock. Its growth is luxuriant and rapid, the stems attaining a length of three to five feet and the yield of forage is very large. The analysis made by Mr. Collier as published in the Agricultural Department Report for 1878 is as follows:

Oil,	1.98	Amylaceous cellulose,	20.64
Wax,	.56	Alkali extract,	18.43
Sugars,	12.49	Albuminoids,	5.61
Gum and dextrin,	5.98	Ash,	6.63
Cellulose,	27.68		
			100.00

ANALYSIS OF ASH.

Potassium,	4.54	Sulphuric acid,	4.63
Potassium oxide,	27.95	Phosphoric acid,	8.48
Sodium,	1.58	Silicic acid,	34.31
Calcium oxide,	7.39	Chlorine,	6.55
Magnesium oxide,	4.57		
			100.00

In the same report, Mr. Pryor Lea of Goliad, Texas, is quoted: "I consider it far superior to any grass that I ever saw for hay. It is a much more certain crop than millet, and cultivated with less labor, and all kinds of stock prefer it. I expect to report a good second crop on the same ground this year. In this region this grass, in the condition of well-cultured hay, is regarded as more nutritious than any other grass. It grows only in cultivated land; it prospers best in the warmest fourth of the year; its luxurious growth *subdues other grasses* and some weeds, with the result of leaving the ground in an ameliorated condition."

The experiments of the present writer and others in Mississippi confirm the above statements substantially of Mr. Lea, except that *it is subdued* by some other grasses. Our hardy crab grass (Panicum sanguinale) especially resists successfully the permanent establishment of its Texan relative. Where the seeds are sown on well prepared ground free from other grass seeds, the plant comes well up to Mr. Lea's statement. But we, with others, have had to abandon it, reluctantly it is true, where other grasses overpower it, in districts noted for fine forage in great variety and perfection of growth. In some of our prairie country, however, and some other portions free from other grasses, it must be a very valuable crop.

Since the foregoing was written, I find that Prof. S. B. Buckley first published a description of this grass in his Preliminary Report of the Geographical and Agricultural Survey of Texas in 1866. I think this grass so important that I quote his description: "Culms erect or subdecumbent, terete, smooth; sheaths shorter than the internodes, subpubescent, and at their mouths hairy; upper portion of the internodes and joints pubescent; leaves six to ten inches long and eight to ten lines broad, long acuminate, under surface subpubescent; panicle compressed, five to eight inches long and five to seven inches broad; rays alternate, erect, lower glume ovate, acute, one-half shorter than the floret, five nerved; upper one seven nerved, acute, hyaline, between the nerves subpubescent, longer than and covering the floret. Several stems often grow from the same root, stems sparingly branched, seed numerous and aggregated.

"Common in the vicinity of Austin, Texas, where it is often cut for hay, for which it is highly esteemed, because it is relish-

ed and eaten eagerly by both horses and cattle. It grows thick and very rapidly, one or two months being sufficient to bring it to maturity enough for hay. It should be cut before the seed is fully ripe. It is said that it will yield sometimes two tons to the acre. Here it is generally permitted to grow in the corn fields, where it springs up in June after the corn is laid by. It is of sufficient maturity to be cut from the middle to the last of August. The corn is often gathered, the stalks pulled, and then the grass is cut with a machine. It thrives best on the Colorado bottom lands, yet I have seen it growing on poor upland soil, but it was dwarfed at least one-half.

"It spreads very rapidly. Those who have a suitable soil can easily propagate it by scattering a few of its seeds in a corn field. It is an annual, hence I do not think it will be hard for those to eradicate who do not wish to continue its cultivation."

This is no doubt the same grass mentioned in the Tallahassee Floridian as quoted in the Southern Cultivator for 1879 page 415, thus: "We have been shown a specimen of the Concho grass, grown by R. C. Long, Esq., of this place, from seed brought by him from Texas, which certainly comes nearer offering all the desired qualities of pasture and forage plants than any we have ever seen." He adds that on the Colorado bottoms, many of the farmers "have devoted their farms entirely to its production, finding it more profitable than corn or cotton. * * * We understand that in Texas, this grass is cut twice, and sometimes three times a year, yielding about one and a half tons per acre at a cutting. The stubble is very heavy, and improves land almost equally with clover."

Further experience will no doubt show that the last statement is erroneous; and this will the sooner appear on hill or other lands not subject to overflow.

18. P. AGROSTIS, Agrostis-like Panic Grass, Munro Grass. For a few years this grass has been experimented with by a number of planters in most of the southern States. Never having grown it, I give from the Southern Cultivator for 1879, pages 425, 426, Mr. Geo. C. W. Munro's account of it.

"The grass I discovered in 1875, has been experimented with more than ever before; and from every State I receive favorable reports of it. G. W. Brown, Miñeola, Texas, writes, September 1st., that it is seven feet high, still growing luxuriantly. —W. F. Rowell, Lodi, Miss., writes, September 16th., that all the seed I sent him germinated, and grew off finely, but that it was so late he feared he would not be able to save seed, as they had just begun to make their appearance. His grass was six feet high. Himself and neighbors were well pleased with it.—

Dr. J. H. Watkins, Palmetto, Ga., writes that it is four feet high, and began seeding September 12, had stood a five weeks' drought without wilting, while crab grass and corn were badly parched up.....

"In order that the public may have all the benefit of my experience with this grass, I have concluded to tell what I know about it in your columns. I have, this year, set one and one-half acres in the plants on land badly worn and cleared about seventy-five years; but a portion of it has been used as a cow-pen, and planted in potatoes, sugar cane, wheat, oats and, last year, in cotton, producing at the rate of one-half bale per acre. This year it was broken deeply, and manured with compost of cotton [seed?] and stable manure, two pounds each to one of Merryman's ammoniated guano, at the rate of 1,000 lbs. per acre, put in the drill and bedded on with long narrow scooter plough, run very deep, rows nearly three feet apart. The plants were set about eighteen inches apart, about the first of April; received two plowings and two hoeings; was cut 18th. July. One row thoroughly dried and weighed by several of my neighbors and land measured; yield ascertained in that way 15,842 lbs. per acre. The test row was under an average, if any thing. Although there had been no rain since July 29th., the grass began putting out and, in four weeks, it was about four feet high, and should have been cut again in five weeks, but I let it stand eight; and although I made good hay I had much trouble with it, as the weather was cloudy and occasionally a light shower.

"Yield the last cutting 7,928 lbs using two rows instead of one as test rows. One was the row used in first cutting. It had several pounds less than the other, and the other was far inferior to some—both upon the whole about an average. Total yield per acre, 23,870 lbs. I should have broadcasted the manure instead of putting it in the drill. I should have had the rows 2 feet apart instead of 3, and the plants 12 instead of 18 inches. It should have been cut at least 10 days or two weeks earlier the first time and 3 weeks earlier the second. I would, in the same space of time that I got two cuttings, have gotten three, and fourth full of seed 1st. of November, the yield of hay would have been greater, the quality better, and the time required in curing lessened. For grazing purposes for cows, and work oxen I do not think it has an equal at the season of year it is on hand. Cattle are more fond of it than any other grass—so are hogs. Horses and mules prefer crab grass, but will eat the other when they can not get the crab. A patch can be continued indefinitely, by taking stock off in time for it to ripen its seeds.

"The seed should be planted in our latitude in January, and if set out, it should be done as soon as the plants get 3 or 4 inches high.

"To sum up, the grass is an annual—begins to seed in September. Can be cut and fed green or cured for hay. Stock are as fond of the hay as they are of corn fodder. It can be used for grazing, soiling, or any other way that any other grass can. It begins to come up in latitude $32\frac{1}{2}^{\circ}$ about the 1st. of March, or a few days earlier if weather is moderate. Makes fine feed for cattle and horses, stands drought well, and has made with a 3 weeks' drought in May and 5 weeks' drought in July and August, nearly 12 tons of well cured hay. Seed are difficult to save, but the grass will seed the land wherever it grows, as crab grass does. It requires very rich land and abhors the shade."

In August, 1880, I received from Mr. Munro, a letter fully reaffirming the above statements. He now says that horses prefer the hay to corn fodder. On rich land it will bear cutting four or five times for soiling if weather favors, or three times for hay. He thinks he can produce 30,000 pounds of hay per acre by heavy manuring. He sows the seed in January or February on a rich garden bed and transplants when the plants are four inches high, the ground being sufficiently moist. He discovered a single bunch of this grass in his garden in 1875, and started with the seed saved from it.

A letter received at the same time from Mr. Rowell confirms the statements of Mr. Munro. He "had last year nine rows forty steps long, which was cut the last of July, cured three days, and made two wagon loads, all that a good yoke of oxen could pull, at least 3,000 pounds. It will seed as soon with as without cutting."

This is not a new grass. It grows naturally on wet lands, two or three feet high; but in cultivation grows much larger on rich land suited to corn. The stems are flattened, erect; leaves long with smooth sheaths; the purplish spikelets crowded, one-sided, on the spreading branches. The resemblance of red top in color and general appearance of the panicle gives the specific name. By saving sufficient seed, one need not have the trouble of transplanting; and by broadcasting, no doubt, a better hay could be produced—not so coarse. This grass is perennial further north; but it is not the only one that has changed in this regard in lower latitudes. Nor is it the only one that has shown like astonishing development under cultivation.

19. P. CRUS-GALLI, (*Oplismenus* of Beauvois,) Cock's-foot Grass. This grass is called also barn-yard grass, and other names. It is very widely distributed in Asia, Europe and America and varies very much in size, in leaves, stems, sheaths and panicles, even in localities not very remote one from another. It is found perfect in all its characteristic parts in specimens that never exceed three inches in height as well as those of seven feet. The spikes range from a few lines to four inches

in length, with or without abundant stiff hairs; the sheaths may be smooth or covered with hairs; and the palets with long awns, or with none. The panicle too varies much in color. The plant is annual with many stems, arising from a common base, each bearing a long panicle with a large quantity of seed which readily fall off even before fully matured. It luxuriates in rich, moist soils.

In Louisiana, Mississippi, and some other States it is mowed annually. Some farmers assure me that they harvest four or five tons of hay per acre. It may be cut twice each season by making the first mowing as soon as it begins to bloom. I know no one who plants it; but it annually reseeds the ground and requires no cultivation, or other care, save protection from live stock and the labor of harvesting.

Being a coarse grass, with long leaves and large succulent stems, it requires care to cure well. In one county in Mississippi, hundreds of acres are annually mowed on single farms. Cows and horses are very fond of it whether green or dry. Farmers who have tested it most thoroughly for many years, prefer it to the best corn-fodder. I have been assured by some that on substituting this hay for corn-fodder, their work animals immediately show decided improvement and require less corn. To make the best hay, it must be cut when in bloom. Cut later the awns and woody fibre become unpalatable and less digestible; and much of the nutritive matter is lost by shattering off the seeds. The Ag. Dept. Report for 1878 gives Mr. Collier's analysis of the plant and ash.

ANALYSIS OF PLANT.

Oil,	1.54	Amylaceous cellulose,	21.37
Wax,	.57	Alkali extracts,	11.03
Sugars,	13.87	Albuminoids,	4.14
Gum and dextrin,	5.07	Ash,	10.14
Cellulose,	32.27		
			100.00

ASH ANALYSIS.

Potassium,	12.00	Sulphuric acid,	3.69
Potassium oxide,	13.26	Phosphoric acid,	4.27
Sodium,	.37	Silicic acid,	42.18
Sodium oxide,	——	Chlorine,	11.48
Calcium oxide,	7.23		
Magnesium oxide,	5.52		100.00

Cultivation and well prepared land would greatly improve this grass.

20. P. JUMENTORUM, Guinea Grass.

The name Guinea grass has often been applied to Johnson Grass, (Sorghum halapense) which see on a subsequent page. The latter matures seed in the United States, while the former seldom does even in Florida. The Guinea grass therefore must be propagated by dividing the clumps or from seed imported from tropical climates, usually from Jamaica. The tussocks may be divided and set out any time of year when the ground is moist enough and the temperature of the air not lower than 40° F. But the best time to set is late in March and through April. If set in April after the ground becomes warm, the plants are up in a few days and by the last of May ready for the first mowing; which with favorable weather may be repeated about every six weeks till frost kills it down.

The roots are very easily killed by cold and must be protected like sugar cane roots in winter. This cannot well be done by throwing earth on, unless it is kept like sugar cane in rows. On hill land I have succeeded best in preserving sugar cane ratoons by covering with the cane tops and fodder. It is probable that the Guinea grass roots might be protected in a similar manner by taking off no grass later than August and then mowing just before frost, or in October and leaving the grass as it falls on the ground. It is too tender to grow at any great distance from the gulf shore; but by protection might be cultivated successfully in the southern portion of all the gulf States.

The subjoined analysis of Mr. Collier shows this grass to be more nutritious than many others, so that with its immense product of hay it is very valuable, especially near the sea shore and on the sandy lands where other good grasses do not thrive.

ANALYSIS OF PANICUM JUMENTORUM.

Oil,	1.27	Amylaceous cellulose,	16.30
Wax,	.31	Alkali extract,	22.60
Sugars,	5.93	Albuminoids,	8.95
Gum and dextrin,	4.51	Ash,	8.37
Cellulose,	31.76		
			100.00

ANALYSIS OF ASH.

Potassium,	8.57	Phosphoric acid,	4.37
Potassium oxide,	35.93	Silicic acid,	16.51
Calcium oxide,	10.18	Chlorine,	7.77
Magnesium oxide,	14.16		
Sulphuric acid,	2.51		100.00

Although this grass will do well on rather poor sandy land, it does much better on richer or fertilized land. Wherever it has had proper care the crop is enormous and satisfactory. A

tropical grass originally from Africa, it is now grown largely in the East and West Indies. In Jamaica it is held next to sugar in value of crop, a single farmer producing five thousand dollars worth per annum of the hay. Propagated to any desired extent by rapid increase of tillers it is esteemed in Florida and other parts of the south as a first class forage plant. Cattle eat it with avidity, green or dry.

Mr. C. Codrington, a former resident of the Island of Jamaica, settled some ten years ago in Florida. Finding the conditions adapted to the growth of Guinea grass, he ordered seeds from Jamaica and planted in 1872. Other persons also in other States had obtained seeds and roots from the same source at various times for fifty years previous to his coming to Florida. But the earlier plantings had finally disappeared. Others since Mr. C. have also imported seed. Mr. C. says he never saw working mules get grain of any kind in Jamaica; and if offered to them they refused to eat it although hard worked, and fed on Guinea grass only.

Mr. James Johnson of Mullet Creek, Florida, received seed from Jamaica and says: "It is a coarse grass, and very sweet. My cattle and horses feed upon it with great avidity, preferring it to all and every other grass, and it certainly makes a rich and nutritious pasture. With this grass I believe Florida, with its mild and pleasant climate, might be made one of the finest grazing States in the union." Much more testimony of the same character could be adduced. This grass revolutionized farming in Jamaica; districts, barren and not susceptible of cultivation previous to the accidental introduction of this grass, because the most profitable parts of the island, producing astonishing numbers of fine live stock for home use and for export.

This grass need cause no anxiety in regard to its introduction. It has not the cane-like roots of the Johnson grass and is easily exterminated. In fact it requires some care to avoid losing it outside the tropics, as the experience of many persons has proved in our southern States. Yet it is worthy of trial on a large scale on our poorer sandy lands in the southern districts of the gulf States. It tillers so rapidly and abundantly that each plant may be separated into many parts a number of times each year—sometimes a single root will supply over fifty new plants at one time.

21. P. MILIACEUM, Common Millet.

This is the 'common millet,' 'cultivated millet,' 'millet commun' of authors. The genus, as shown under the head The Millets, has been cultivated from very early times, (being the dochan of Ezekiel,) in all the countries from Southern India to Central Europe: and later in Western Europe. It was brought from India to England in 1596, and has been long known to a

limited extent in the United States. There are several varieties of it, founded on difference of color of the panicle or seed. On good land, it attains a height of three to six feet, resembles dwarf broom corn, produces much foliage and a panicle of which the branches heavily loaded with seed all incline to the same side.

For feeding stock it should be cut, like the setaria, when in bloom. It is then tender, digestible and very nutritious, and may reach seventy bushels per acre if well cultivated.

In order to show something of German industry, methods and careful culture, we make a few extracts from the celebrated Thaer's great work, "Principles of Agriculture." Though of humble birth, his fame became so great that his friendship was sought by the most celebrated agriculturists of England, France, Denmark, Germany; almost all the great sovereigns of Europe complimented him on his great success; those of Prussia, Russia, Saxony, Hanover, Bavaria and Wurtemburg sent him their orders of knighthood; and noblemen from all parts of the world came to visit him, especially from England.

He writes: "The common millet is preferred as having the largest grain; and the German millet as being least liable to shed its grain, as ripening more quickly, and as not being so much robbed by birds. The cultivation required by both is the same or nearly so.

"Millet requires a warm, rich, sandy, well pulverized soil. It succeeds better when sown after some crop which has been abundantly manured than it does when sown after an amelioration of undecomposed manure.

"A soil must be tilled to a great depth for its reception, and plowed three times, besides being harrowed, rolled and thoroughly freed from weeds. Many farmers dig their ground to a great depth previously to sowing it with this plant; but a good plowing answers the purpose equally well. Millet is in general very successful on newly drained land, provided that it is in good condition, and also land which has been left in repose for several years. In the latter case a single plowing is sufficient, if the soil is subsequently harrowed and well broken up with a roller before the seed is put into it.

"Millet should be sown in May; about three metzen of seed is the quantity usually used per acre; a harrow then is lightly passed over the soil, and where the ground is dry, a roller also must be used. The seed must be thoroughly ripe, perfect and free from disease.

"As soon as weeds make their appearance among the millet which is just shooting above ground, they must be eradicated by weeding. This is absolutely necessary, if we would not endanger the success of the crop; and can only be dispensed with where the land has only lately been drained and brought into

cultivation, and consequently has few or no indigenous weeds. It is on this account that millet can seldom be cultivated to any great extent. One weeding is rarely sufficient for it; for, if the soil is at all disposed to produce weeds, it will require a second, if not a third—each one following about a fort-night or three weeks after the other.

"The best way is to tear up the weeds with hand rakes constructed for the purpose; this mode of proceeding answers far better than hand weeding, as by its means not only all the weeds may be eradicated, but the supernumerary plants may be thinned off. The effect of this cultivation on the success and vegetation of the crop is wonderful; after it the millet shoots up so rapidly that the weeds seldom have time to grow again, or, if they do, it is in small numbers, and they may easily be pulled up.

"Great attention is requisite to seize on the exact moment at which the plant attains maturity, especially with common millet, which ripens very unequally, and is very liable to shed its seed. This evil is, however, much less to be feared where the crop has been cultivated, and thinned in the way we have mentioned. Those who cultivate millet only in patches, cut off the spikes as they ripen, and carry them home in sacks; but as this can be done only where the plant is cultivated but little, the reaping must be commenced as soon as the greater part of the plants are ripe, and performed with great care with a sickle.

"This plant must not be left on the ground in swaths, because if rain comes on, and it gets wetted, it sheds its grain. It should, on the contrary, be immediately carried to the barns and there threshed, and freed from all impurities and foreign substances as much as possible. The grain should then be spread in very thin layers over the floor and stirred about every day with a rake until perfectly dry, otherwise it will become heated and bitter. The straw is tied up even though moist, and carried into the air to be dried; if not properly dried it will become mouldy on being stacked. This straw is much esteemed as provender for cattle.

"Although when cultivated to any great extent it is not possible to cut off the ears separately as they ripen, it is worth while to gather all those is this manner which will be required for seed. Grain which ripens thoroughly, and of which proper care has been taken, shoots up evenly, and produces perfect plants, free from disease, and especially from smut, which frequently manifests itself in this grain where proper precautions have not been taken. The portion of millet which is intended for seed should be preserved in some place through which there is a free circulation of air, and where it can become perfectly dry; it should be threshed when wanted. The best way of freeing millet from its husk is by making use of mills somewhat re-

sembling fulling-mills, which beat it with sticks or hammers.

"Millet is well known to be a very nutritious grain; in most countries it forms an article of rice. Consequently its price generally bears a relative proportion to that of rice.

"Millet also is cultivated as fodder; it is then sown more thickly, and mown as soon as its panicles are developed." Pp. 428–9.

The three 'metzen' are equal to about three pecks, and contain about the quantity of seed to sow per acre. This common millet may be sown here any time from April 10th, to July, perhaps later. None of the millets, indeed no other plants, receive so much cultivation in this country as in Germany or Prussia. Thaer's *remarks on maturing and saving and preserving seeds are specially valuable; and if generally practiced, we should have better stands, more vigorous, healthy growth, and larger, heavier, sounder crops of all kinds.*

Prof. Flint says of this grass: "It is one of the best crops we have for cutting and feeding green for soiling purposes, since its yield is large, its luxuriant leaves juicy and tender, and much relished by milch cows and other stock.

"The seed is rich in nutritive qualities, but it is seldom ground or used for flour, though it is said to exceed all other kinds of meal or flour in nutritive elements. An acre well cultivated will yield from sixty to seventy bushels of seed. Cut in the blossom, as it should be, for feeding to cattle, the seed is comparatively valueless. If allowed to ripen its seed, the stalk is no more nutritious, probably, than oat straw.

"Millet requires a good soil, and is rather an exhausting crop, but yields a produce valuable in proportion to the richness of the soil, and care and expense of cultivation."

The seeds weigh forty pounds to the bushel.

22. P. GIBBUM, grows in low, wet lands.

23. P. DIVARICATUM, Small Cane, found in the Gulf States. Both perennial natives and perhaps one or two more of these Panic grasses possess considerable value; but they cannot be cultivated profitably and need no special attention.

The Millets.

Having made a careful study of this subject, in 1877, in the New Orleans Picayune, I published an account of many of the plants that have received this name. I here present some extracts from that account which run through three numbers of the Picayune.

This word is so comprehensive, is applied to so many plants widely differing both in appearance and botanical characters, there is so much confusion in the use of the word, and the subject is so important that it will be proper, and even necessary,

to enter into some historical investigation and details, in order, if possible, to dissipate the confusion and relieve the subject of its embarrassments.

Let us see, first, what the two great American dictionaries say: Webster gives "Millet, [Fr., millet, or mil; It., miglio; Sp., mijo; L., milium; Sax., mil]. 1. A plant or the grain of a plant, of the genus Holcus, or Sorghum, having a stalk resembling a jointed reed, and classed by botanists among the grasses. Various species are used as food for men and animals, but the Indian millet is the most common. The species are mostly natives of warm climates.—*P. Cyc.* 2. Millet grass, or millet, a hardy grass of the genus Milium, of several species.—*Farm encyc.*

Worcester tells us, Millet, [L. milium; It. miglio; Fr. mil, or millet—A. S. mil, millet]. (Bot.) A genus of tall grasses, with succulent stems, native of the tropical parts of Asia; Sorghum.—*Eng. Cyc.*

The species have been referred to Holcus, sometimes to Andropogon. Sorghum vulgare is the largest of the small cereal grains, and may be considered the representative of the Indian corn of America, where it is usually called Guinea corn, and in some works, the great or Indian millet.—*Eng. Cyc.*

Millet grass, a genus of grasses, of several species; milium.—*Loudon.*

However correct these definitions may be, the two "unabridged" dictionaries and the four encyclopedias quoted by them certainly afford little information touching anything known as millet in our southern States. A number of other dictionaries and encyclopedias are equally unsatisfactory. As no one will be apt to mistake the milium, or millet grass of the last sentence of each of the definitions, for what we call millet, it may be excluded from further notice in this investigation.

The earliest mention of millet that I remember is found in Ezekiel, iv, 9, in the year 595 B. C. In the Hebrew it is dokhan or dochan and identical with the Arabic dukhun. It is rendered in the Greek of the LXX kegchros, Latinized cenchrus. The Latin Vulgate has it milium; Diodati's Italian, miglio; Miguel's Spanish, mijo; Luther's German, hirsen; the French, Paris edition 1805, millet.

Modern botanists do not apply the names cenchrus and milium to the same plants to which they were applied in the above and other ancient writers; so that the common reader gains but little additional knowledge here.

Pliny (XVIII, 7,) says: "As touching the millet, the head thereof bearing seed roundabout, is bent likewise and curbed, beset also with fringes (as it were) of hairy fillets." This seems best to describe what for centuries has been known in Europe as "common millet" (Panicum miliaceum), mentioned on page 100.

Herodotus (Clio, exciii,) speaking of "the Babylonian district," 400 years B. C., says: "The immense height to which millet and sesamum will grow, although I have witnessed it myself, I know not how to mention. I am well aware that they who have not visited this country will deem whatever I may say on the subject a violation of probability."

This also may refer to the "common millet" of Europe, though Herodotus may mean the holcus or sorghum of the dictionaries we have quoted. For I think it very probable that a species of the latter took its name from the locality mentioned by Herodotus, since Daniel when a prisoner at Babylon (B. C. 580) speaks of the golden image erected on the plain of *Dura*, (Dan. III, 1.)

Forskal applies the name dukhun to a corn grass much larger than the common millet, which he first found at Rosetta; and subsequently he found it commonly cultivated in Arabia, where it attained a height of five cubits, with seeds the size of rice. He calls it holcus dochna, which, probably, is also the sorghum of the dictionaries, or dura, durra, or doura corn, and being more than twice the height of the common millet, agrees with the height of Herodotus's millet.

This view is confirmed further by Watson, who says: "It has been supposed that the dochan means what is now called in the East durra, which according to Neighbor, is a sort of millet, and when made into bad bread with camel's milk, oil, butter or grease, is almost the only food which is eaten by the common people of Arabia Felix.... It is also used in Palestine and Syria, and it is generally agreed that it yields much more than any other kind of grain."

Many more authorities might be cited, but not wishing unnecessary accumulations, we think that we have now clearly shown two genera of millets, viz: 1. Common millet, (panicum miliaceum,) and 2. Indian millet, (sorghum vulgare.) Each of these appears in many varieties, and will receive further attention in their appropriate places in this book. None of these however, seem to be known to our southern people as *millet*. A third genus,

Setaria.

The old Panicum Germanicum and P. Italicum, now classed by botanists as

1. S. ITALICA or GERMANICA; for they seem to be only varieties of a single species. They are called Bengal grass, Italian millet, German millet, golden millet, Hungarian millet, etc. The German millet was brought from Southern Europe to England in 1548, and the Italian from India in 1816, where it is called Congue. This German millet or Hungarian grass was

introduced into France in 1545, and thence into the United States through the Patent Office.

Among other seeds ordered from a house in New York were a pound each of Hungarian grass and common millet. Each package had a printed slip pasted on, disclaiming all responsibility for genuineness; although I had ordered expressly for the purpose of arriving at the truth by my own personal observations. Not a seed of either germinated. I ordered seeds for the same purpose from a house at Northport, L. I., also. The Italian millet and Hungarian grass prove to be the same, or so nearly so that very few persons seeing a sheaf of each together would be willing to say they are not the same plant. I sowed other samples from other States with like results. Lastly, I sowed six acres with seeds of German millet from Missouri, a bushel per acre. It was harvested last week. Among it are fine specimens of German millet, equally good of Italian millet, very much better than that from the Northport Italian millet seed.

There are also specimens of golden millet, Hungarian grass etc., all from the same seed—all good. It was planted on broom grass sod during a drought, and had no rain till after ready to mow; consequently, except on half an acre, the stand was very thin. It pays me, however, very well. Finding I would get too much dirt and dust by cutting and raking when it was just in bloom—in the right stage to be most valuable for forage—I purposed waiting a few days for rain, so as to avoid the dust. When the rain came, it was so copious that the ground became too soft to support either team or machine; so I was forced to delay mowing for two weeks, when part of the seeds were in dough. A small plot—an eighth of an acre—was seeded from the same sample by accident. The plot was poor, part with no soil. This produces a good thick stand, but not a stem of "German" or "Italian millet," according to the standard; only the poorest possible Hungarian grass.

Yet I was not disappointed in the result. It simply shows the effect of soil and other influences in producing varieties. By sowing a lot of these seeds from any of the varieties, or whatever called, in two years, by selection of heads and soils, half a dozen distinct varieties may be established. But on soil of even quality there will be little variation. Any of these varieties on good soil should, if the ground be moist, be ready for mowing in sixty days from seeding, and produce from two to four tons of hay per acre. It is folly to sow it on poor land.

For forage it should be cut as soon as it blooms, when of course it is worth nothing for seed but most valuable for forage and exhausts the land much less. If left for the seed to mature they are very abundandant and rich feed, but the stems are worthless, while the soil is more damaged. The matured stems are

very hard, indigestible and very injurious, and the ripe seeds will founder more promptly than corn and sometimes produce diabetes, if mouldy and too freely used. If cut at the right stage the whole plant is a safe and very valuable forage. Most people delay cutting too long.

It should be carefully and well dried. If suffered to mould, or mildew, or ferment it will become almost worthless, and may even become dangerously unwholesome for animals. In Hungary it is said to be preferred to everything else for feeding horses. It is the Moha de Hongrie of France. For seed it is better sown in drills; for forage broadcast to prevent the stems growing too large. In 1875, there was a mania for German millet seed, which run them up to $20 a bushel in some localities. In two years, as predicted, the seed in some localities fell to fifty cents a bushel; so many, not knowing how to manage it were so sadly disappointed in their expectations of a crop and its value.

The German millet grown in Tennessee seems to be the best variety; the plant is larger and head much longer. It stands drought well, waiting for rain, has a large quantity of succulent leaves relished greatly by all farm stock, and is thought to contain a larger proportion of nutritive matter than any of the other so-called millets. For forage it should be sown broadcast, one bushel per acre. Thick seedings prevent the stems from becoming too large and hard. For seed ten or twelve quarts per acre in drills will suffice. It will grow from one to seven feet high according to the quality and condition of the land, and yield from one-half to five tons per acre, with as great differences in the appearance of plants as in quantity of forage.

For using alone for feeding working animals, I much prefer it to corn, oats, or anything else. I have made many experiments with many kinds of feed, but never found anything more satisfactory than German millet alone fed for two months to teams daily working.

Another grass classed with the millets is treated on a subsequent page under the title *Penicillaria*; and a fifth under the name *Panicum sanguinale*, treated on page 88. This last is the *Digitaria sanguinalis* of some authors, the manna grass of the Germans. It is sometimes cultivated in Poland for the grain as a substitute for rice. etc., and hence called *Polish millet*. It seems to thrive there under cultivation about as well as with us in spite of attempts to exterminate it. It is not red or bloody in appearance as might be inferred from its specific name and as taught in some books. The name is said to have been founded on a practice of idle, vicious boys in Germany thrusting the spikes up the nostrils and thus causing a sanguineous flow.

We have in the southern States six other uncultivated grasses properly belonging with the Millets, and to the genus *Setaria*

2. S. SETOSA, Texas Millet, Pigeon grass, Bristle grass.

Some years ago I received seeds of this grass from Texas; and at first it was mistaken for *S. Italica*, which it resembles in general appearance, though much larger. It has broad, long, light leaves and a stem from six to twelve feet or more high, bearing cylindrical racemose spikes from eight to thirty inches long, tapering to each end, gracefully nodding, and altogether making a fine display. The spike is extremely bristly, and produces a very large quantity of seed, which maturing from the top of the spike downward, are constantly dropping for many days. It is much disposed to branch at every joint, and sometimes the branches also send up other branches; and all these terminate in seed bearing spikes. The whole plant is very light. Mr. Collier's analysis of it gives: oil 1.05, wax .46 sugars 9.25, gum and dextrin 5.15, cellulose 32.76, amylaceous cellulose 26.41, alkali extract 9.60, albuminoids 8.61, ash 6.71. His analysis of the ash gives: potassium oxide 39.33, sodium 2.47, sodium oxide 1.18, calcium oxide 2.31, magnesium oxide 1.56, sulphuric acid 3.51, phosphoric acid 3.24, silicic acid 42.59 chlorine 3.81.

Although containing so much nutritive matter, none of my animals can be induced to eat it. So that its utility is in the way of ornament.

3. S. VERTICILLATA, Bristly Foxtail.

This foreigner seems at home with us. The stems are two feet high sparingly branched and topped with cylindrical pale green spikes two or three inches long with bristles short, single or in pairs, roughened downwards. All the following have bristles roughened upward.

4. S. GLAUCA, Fox-tail Grass.

Stems one to three feet high, branched; tawny-yellow, or purplish spikes two or three inches long; bristles six to ten in two clusters, common.

5. S. VIRIDIS, Green Fox-tail, Bottle Grass.

Stems one or two feet high; spike one or two inches long, green; bristles one to three to each spikelet.

6. S. CORRUGATA, Wrinkled Fox-tail.

Stems two or three feet high; purple spikes three to six inches long, compound, dense; bristles one to each spikelet.

7. S. COMPOSITA, Large Fox-tail Grass.

Stems two to four feet long; spikes six to twelve inches long; bristles single or in pairs, long.

These grasses are widely diffused in fields, commons, along and in roads and open forests. Some of them afford grazing—none are of much value for that purpose. Poultry are fond of the seeds, and they probably serve a similar purpose as those of the German and common millets in increasing the egg crop, for which the latter are so much esteemed.

Penicillaria.

P. spicata, African Cane, Horse, Cat-tail, Egyptian, Japan, East Indian, or Pearl Millet.

This grass has been grown to some extent for twenty-five years in many parts of the southern States—more largely since 1865. Like all the other millets it should be planted on very rich, well prepared land to obtain the best results. It may be planted in the spring as soon as the ground is sufficiently warm to bring it up promptly, one peck of seed per acre in drills two feet apart, or two pecks broadcast. No crop will pay better or yield more forage than this on very rich, highly fertilized land. On such land it has been cut on an average every forty-five days from the time of planting till frost, with a reported product of 80 to 100 tons of green forage, or from 16 to 20 tons of dry hay. At the beginning of the season if the ground is too wet and cold, it starts slowly; but as the temperature rises and more roots are made its growth is more rapid so that it becomes marvellous, increasing from six inches a week in the beginning to fifteen or twenty inches a week in the summer—the whole number of cuttings in the season aggregating a total length of twenty or twenty-five feet. It tillers enormously and produces a large number of broad succulent leaves and sweet, juicy stalks with rather short joints and terminal spikes that resemble in general appearance the common cat-tail growing in southern marshes.

Where it grows luxuriantly, it is impossible to cure it for hay on the ground upon which it is grown; so that it would be impracticable to make hay of a large field of it sown solid. Hence it must be sown in small patches or in beds with spaces between upon which to spread it when cut. Another serious trouble would occur in the attempt to cure the grass on the ground where it grew. When cut, it would cover the stubble so deep and be so long curing that much of the latter would be killed and all damaged. These difficulties would occur only on rich land to begin with and then manured with five or ten tons or more of stable manure or its equivalent per acre. But any one can have the crop as light as he chooses, even less than half a ton per acre, by sowing on poorly prepared and exhausted land. It will be readily understood however, that the best plan is to sow small patches on the strongest land on the farm; for on most farms a small surface of good land would produce enough of the forage whether to use green or dry.

To make the best hay, it should be cut before seeding; for feeding green, it may be cut many times. It should always be cut a few inches (three, or four) above the ground, as new growth will thus be more prompt than when cut close to the ground.

Cattle and horses eat it greedily whether green or dry. If matured for seed before cutting, the stalks become so hard that they are worth no more than stripped, dry corn stalks.

Planters, on the bottom lands of the Mississippi river and its tributaries, who buy hay, would find themselves much more cheaply, abundantly and satisfactorily supplied by sowing small lots of this or Johnson grass on their dryest, richest lands.

CENCHRUS.

1. C. TRIBUBULOIDES, Hedgehog, or Bur Grass.

This grass, with prostrate stems one or two feet long, spikes one or two inches long and having ten or fifteen involucres armed with spreading spines which become a hard burr, is found on the sands along the coasts and at some places many miles inland.

2. C. ECHINATUS, Cock-spur is found in fields and on waste lands further inland; the stems one or two feet long; spike three or four inches; involucre purplish, with spines and barbed bristles. These are worthless weeds, and the burs with their rigid spines pierce painfully the bare feet of children and have to be removed by the hands or an instrument.

STENOTAPHRUM.

S. AMERICANUM, Hard Grass.

This perennial evergreen grass makes excellent winter pasture; but it is limited to damp sandy soils along the coast. Its culms are creeping, flattened, with erect flowering branches six to twelve inches high; leaves two to six inches long; spikelets by pairs, one sessile the other pedicelled, sunk in excavations of the flattened rachis.

ROTTBŒLLIA.

R. RUGOSA, and R. CORRUGATA.

These are found in barrens, swamps and ponds, from two to four feet high, and *R. cylindrica* in dry sandy soil in Florida and are probably worthless for stock food.

MANISURUS GRANULARIS is a foreign grass, one or two feet high, now found in fields and pastures in the southern States, of little value.

ANDROPOGON.

A. VIRGINICUS, Virginia Beard Grass, Broom Grass.

This plant is often called 'broom sedge.' But this anomalous compound word is properly excluded from all dictionaries and is recognized by no standard author. It should find no place

in any language, oral or written; for each of its components contains a false notion, as the plant does not belong to either the broom or the sedge family. It is a true grass. '*Broom-grass*' is pretty widely used, but a number of other plants have the same name; hence this is not entirely satisfactory. *Besom-grass* would be open to none of the objections, but contains an expressive truth.

The *andropogons* have long rough leaves and solid woody stems. Few of them are of sufficient agricultural value to require notice. The *A. Virginicus*, however, contains a large quantity of nutritive matters as will be seen by Mr. Collier's analysis, which follows:

Oil,	1.24	Amylaceous cellulose,	26.32
Wax,	.47	Alkali extract,	5.80
Sugars,	7.98	Albuminoids,	13.00
Gum and dextrin,	5.02	Ash,	6.44
Cellulose,	33.72		
			100.00

ANASYSIS OF ASH.

Potassium,	7.01	Phosphoric acid,	2.97
Potassium oxide,	13.93	Silicic acid,	58.33
Calcium oxide,	6.76	Chlorine,	6.37
Magnesium oxide,	1.83		
Sulphuric acid,	2.80		100.00

When this grass dries, it may be burned off in the fall; and in the spring the perennial roots send up a new crop of nutritious and tender herbage which cattle, horses, etc. relish and eat with much benefit. As soon as the seed stems start, stock eat no more of it. It becomes worthless for grazing or hay. If cut before the stalks start up, it is very easily cured and makes a valuable hay. It is easily damaged by moisture and therefore should not be allowed to take rain or dew after wilting. A few hours' sunshine will cure it and make a better hay than large quantities of some other kinds sold annually in all our southern markets.

It is one of the best materials for the use of nurserymen in packing their trees and plants. Excellent, durable, handsome baskets are made of it—also bee-hives. Horse collars and other things are stuffed with it; and the dried culms, having the leaves and seeds hackled out, are formed into besoms, that are light, pleasant to use and sweep cleaner than the proverbial new broom from the store.

The practice of burning off annually the broom grass, whether in fields or forests is very reprehensible. It dissipates the valuable organic fertilizers which the plant contains and gives opportunity for the rains to wash away the rich mineral plant food

in the ash, and otherwise damages the soil most seriously. Each acre of it plowed under is worth as much as many tons of home made manure that cost much time to make, haul and distribute over the land. Plowed under any time from the 15th. of May till the 20th. of July, the land immediately sown broadcast with one or two bushels per acre of southern field peas and harrowed, a good crop of the latter may be cheaply produced. The earlier peas that make much vine may be mowed and removed to furnish abundant hay for winter use; or the vines may have a heavy roller passed over them and then be plowed under in September and October with oats or barley. Magnificent winter pastures will be obtained from December first till March; and in May and June such harvests of barley and oats as are rarely seen. The broom grass is destroyed, the land is mellow and, if not desired for other crops at once, may, if the season be favorable, soon be covered with 'volunteer' pea vines. But turn on the stubble no stock, except hogs to glean the remaining grain for a few days, plow the stubble under in beds, and the ground is in the best condition for producing sweet potatoes. Harvest these in October, harrow and roll the ground and it is just right for receiving red or white clover, blue, orchard, red-top, meadow oat, or other winter grass seed.

Again; this grass may be plowed under any time from August first till fifteenth April; the land then planted with cotton seed from tenth to twenty-fifth of May will produce a largely increased yield of cotton.

The *A. macrourus*, Cluster-flowered beard grass, *A. furcatus*, Finger-spiked beard grass, *A. Elliottii*, Silver beard grass, and *A. scoparius*, Purple wood grass, Broom grass, contain much less than *A. Virginicus* of animal or valuable plant food. They would not pay for harvesting unless the stock-feeder had concentrated food and could obtain no better food to use with it. Mr. Collier's analysis of A. scoparius follows: oil 1.16, wax .43, sugars 5.37, gum and dextrin 3.44, cellulose 24.91, amylaceous cellulose 26.51, alkali extract 28.07, albuminoids 6.21, ash 3.90 to 100 parts of the dried grass. His analysis of the ash gave: potassium 15.70, calcium oxide 2.12, magnesium oxide .58, sulphuric acid trace, phosphoric acid 1.33, silicic acid 64.62, chlorine 15.65.

Six other species not mentioned here are found in the southern States. *A. melanocarpus* is remarkable as the largest, being from four to eight feet high and probably introduced.

TRIPSACUM, Sesame Grass.

T. DACTYLOIDES, Gama Grass.

This native perennial grass was formerly found widely diffused through the southern States from the seashore to the

mountains. It is now seldom seen and but few protect it. It has been destroyed by cattle. Some forty or more years ago, many people in Mississippi and Louisiana planted patches of it; a few of which remain. All kinds of live stock eat it with a good relish when green and are fond of the sweet, nutritious, but coarse hay. It may be cut five or six times a year under favorable conditions and yields an immense quantity of good forage. I have measured the broad leaves of this grass seven feet long and culms ten and a half feet. The latter are worthless and the grass should be cut before the stems run up. The flowers are arranged in from one to three compact spikes at the top of the culm; sometimes on branches also. At the top of the culm are the male flowers, consisting of the elongated orange or brownish colored anthers each set attached to a joint of the stem, one joint above another; below these are other joints bearing the female flowers or stigmas consisting of long velvety, dark purple threads. The top joints soon drop off; then as they mature from above downwards the lower joints successively fall. The latter contain each, one seed, many of which seem to be imperfect as they do not germinate readily. Hence it is best propagated by setting out the large rhizomes, which are abundant on the surface of the ground and often piled in large quantities on one another. These rhizomes are half an inch to an inch thick and from the under side send down into the soil many large, strong fibrous roots. Each rhizome has one bud; but if more it may be divided into as many parts as buds. It may be set from January to last of March. When once well set it requires a team of at least six good oxen and a very large strong plow to tear it up. It turns up in large masses of one to two feet across and these cannot be crushed or broken in pieces; and as the rhizomes are not killed by this process, the planter is in worse condition than if he had not plowed it and no nearer rid of it; unless he piles it with immense labor with fuel intermixed or hauls it away. It is however, very easily destroyed by keeping cattle and other stock grazing it during spring and summer. It grows well in marsh, better on hills, best on rich, moist bottoms.

Analysis of Gama grass by Mr. Peter Collier.

Oil,	1.72	Amylaceous cellulose,	20.84
Wax,	.68	Alkali extract,	23.09
Sugars,	8.84	Albuminoids,	8.62
Gum and dextrin,	3.66	Ash,	5.96
Cellulose,	26.59		
			100.00

ANALYSIS OF ASH.

Potassium,	6.30	Sulphuric acid,	3.69
Potassium oxide,	29.06	Phosphoric acid,	2.52
Sodium,	4.77	Silicic acid,	37.87
Calcium oxide,	1.64	Chlorine,	13.08
Magnesium oxide,	1.07		
			100.00

ERIANTHUS, Fox-tail.

E. ALOPECUROIDES, Woolly Beard Grass, Plume Grass.

This grass grows from four to ten feet high, with panicle one or two feet long, pyramidal, woolly; sheaths of the rough leaves woolly above. The variety *Contortus* is smaller, smoother and has twisted awns. The variety *brevibarbis* is also smooth, smaller, has short hairs, and hence called short haired woolly grass. *E. strictus*, nearly smooth throughout and four to eight feet high, is found, like the others, on dry or wet lands and river banks. They are not valuable for forage, but the first is quite ornamental with its graceful, large, plumose panicle.

SORGHUM.

On another page, (103) under the general head of *The Millets*, this grass is partly considered, forming there the second division of millets, that of the dictionaries: SORGHUM VULGARE, *Indian millet, great millet;* Fr. *Sorgho, gros millet;* Ger. *Sorgsamur;* It. *Sagina;* Sp. *Molce, Alcandia.* This is the Durra or Doura of Arabia, Persia, etc.; Jovaree of India; Nagara of North China. It was brought from India to England in 1596, and to Cuba in 1824, and thence to Florida, etc.

In our southern States, we have three native species of sorghum, viz: 1. *S. avenaceum*, oat like sorghum; 2. *S. nutans*, Indian grass, wood grass, nodding sorghum; 3. *S. secundum.* These are of little value as found in sterile woodlands; and I am not aware that they have ever been cultivated.

There has been much diversity of opinion among botanists about the foreign species; some contending for one species and many varieties; others for several species, each presenting varieties. The varieties are almost numberless. In a collection of plants sent to the Museum of Natural History, at Paris, in 1840, by M. d'Abadie, there were *thirty* kinds of sorghum; and in 1857 Mr. Wray arrived in the United States, bringing with him the seeds of *fifteen* varieties of South African sorghum, or imphee. Other varieties have since been introduced. But we cannot recount the history or even the names of these varieties; to do so would require a large book. The most noted species or varieties besides the S. VULGARE are: 1. S. CERNUUM, *Guin-*

ca corn, with densely contracted panicle, and cultivated for the grain: 2. S. HALAPENSE, *Cuba grass*, cultivated for soiling, grazing, and hay; and, 3. S. SACCHARATUM, sweet sorghum, Chinese and African sugar cane, cultivated for the juices of the stems and the broom corn for brooms. The seeds of all the varieties are valuable food.

The *S. vulgare*, great or Indian millet, has been much cultivated from the earliest times in India and across to Southern Europe and Africa and thence extending to all countries sufficiently warm. It was and is yet used in many countries not only as food for inferior animals, but also for man. It has been, at different times during the last sixty years, extensively advertised for sale in various parts of the United States under taking names and extravagant commendation, as chocolate corn, doura corn, Indian millet, Chinese wheat, Oregon rice, ivory wheat, upland or highland rice, pampas rice, etc.

Quite a number of planters of Mississippi have cultivated it during the current and a few preceding years. All with whom I have conversed speak very highly of its nutritive and fattening properties for hogs and other animals and of the large yield of grain. They agree also that it makes a good, wholesome flour, for bread, cakes etc., while all relish it as a substitute for cracked wheat. Some of our own family esteem it as very palatable and desirable food. Of course poultry and other birds devour it greedily. The only trouble I have experienced with it is, if a small quantity only be grown, the birds devour so much as it matures and before ready for harvesting.

There are many varieties of S. vulgare, but for the table, that with large open panicle and pearl like grains is preferable, while it is as valuable as any other variety for animals—in fact, I prefer is for them. Bearded varieties are not so much damaged by birds. After harvesting all are liable to be destroyed by the weevil.

It may be planted in April and cut several times during the season. In common with other sorghums it bears drought much better than corn, or any of our small grain. When it heads, cut off the top, and immediately other heads shoot out from every joint and many new stems from the root, all which may be used as needed. When thus cut it continues to renew its growth till frost, unless prevented by drought. In all warm countries it is unanimously acknowledged to yield much more than any other grain.

S. *cernuum* seeds are used for the same purposes as those of S. *vulgare*. The leaves of both are nutritious and are eaten by stock. They frequently eat the entire stalk.

The grains of the S. saccharatum may be used also for the table but are not so nice as the two preceding. They are perhaps equally valuable for stock feed. The whole plant has

been used by some over a wide extent of our country for longer or shorter periods since 1855, as feed for horses, cattle and hogs. Some praise and others condemn in strong terms. All agree that the leaves stripped off and dried like those of Indian corn make a fodder superior to the latter. They require more time to dry for obvious reasons. When the cane is ready to cut for rolling, the leaves are stripped and managed as those of corn, and the tops or heads cared for properly. Thus, much good forage is secured for the animals, and from fifty to two hundred gallons of syrup per acre for the people.

If the cutting is succeeded by rains, there will be a second growth for forage. Taking off such heavy crops must proportionately exhaust the land. Among the first as well as last to plant and use the sweet sorghums for soiling and fodder, I have never, in a single instance, had any bad effect on or injury of an animal. Where evil has resulted it must be from bad management. For feeding stock, the plant may be cut several times during the season; and the stalks should be passed through a stalk-cutter.

The S. *vulgare* sometimes has a very large open panicle with long nodding branches; and it varies from this form to a very short-branched, densely compacted, rigid, erect, club shaped panicle.

S. *cernuum*, Guinea corn, Chicken corn, recently White Egyptian corn. This has all the variety in form of panicles as the preceding, differing in having the peduncle very long and reflexed, turning the panicle so as to point directly down. This is the perfect character; but often it is bent further and across itself; and then it varies in the other direction, so that panicles may be found inclined at all angles with the horizon. From my own study of these two so-called species, under conditions miles apart, where they could not possibly intermix. I am convinced that they are but one, with a natural tendency to return to the erect form of open panicle. Both are to be planted and cultivated alike. Plant in rows three feet apart, dropping a few seed from twelve to twenty inches apart, using about four quarts clean, sound seed per acre, or drill thinly about a bushel. About two workings with a good cultivator will suffice if the ground be in good condition to begin with; if not the hoe may be needed and other work.

S. *saccharatum*, Imphee or African sugar cane, (S. nigrum, black or Chinese sugar cane being probably only a variety,) may be planted and treated in all respects in the same manner as a forage crop; for which I prefer it very much to the varieties of Doura. The broom corn belongs to S. *saccharatum*, but is worthless for forage, except the seed which are very nutritious. For syrup and sugar the bent-top variety is, in my locality, decidedly the best, being more easily clarified and granulated,

yielding more and waiting longer without deterioration after ready for the mill.

The bent top variety produces more seed than the others, but stock do not relish them so well; probably from the head, when fed unthreshed, making too large a mouthful for comfortable mastication and from its being more bitter than other varieties when immature or not dried. Like the bent-top Doura corn, the peduncle has a tendency to rise up, and panicles may be seen at every angle with the horizon, both above and below; and also a tendency to change from the short branched, close packed, to the open, long, nodding branched panicle. And in proportion as it assumes the latter characters, it becomes more a broom or Doura corn and less a sugar cane.

For sugar, seeds should be carefully selected in the field. Stalks with the most compact panicle and bent peduncle should be selected and remain until the seed are perfectly ripe. After removing the panicle, the stalks will still be good for sugar or syrup. For seed, only those stalks should be taken with the head turned down so far as to touch the stem below or even cross it. This variety requires a longer time to mature than the others, but it is very much larger. For syrup it should have more room than when planted for forage—having rows at least four feet apart.

All these sorghums send roots down several feet deep and make more and better syrup on gravelly or sandy sub-soil. If the bagasse or stalks are returned and plowed under, the land is very little exhausted. I have seen them grown for years on the same thin land without fertilizers and with little sign of exhaustion.

Before dismissing the sweet Sorghums, perhaps I should state that the longer they are permitted to stand after maturity, the greater tendency I find to generate formic acid in boiling the juice for syrup. This tendency is decidedly greater in the bent-top or goose-neck variety than in any other I have tested. This acid, so difficult to eliminate while making the syrup, being offensive in odor and flavor, damages syrups otherwise most perfect.

Sorghum nutans, Indian grass, Wood grass.

This and the two other native species, mentioned on a preceding page, are of little nutritive value as will be seen by Mr. Collier's

ANALYSIS OF SORGHUM NUTANS.

Oil,	1.57	Amylaceous cellulose,	27.25
Wax,	.10	Alkali extract,	14.44
Sugars,	7.27	Albuminoids,	3.29
Gum and dextrin,	3.75	Ash,	5.63
Cellulose,	36.70		
			100.00

ANALYSIS OF ASH.

Potassium,	6.74	Phosphoric acid,	2.35
Potassium oxide,	16.84	Silicic acid,	61.55
Calcium oxide,	2.92	Chlorine,	6.11
Magnesium oxide,	1.36		
Sulphuric acid,	2.13		100.00

This plant ranges from 3 to 6 high including the panicle one or two feet long. The other two species are smaller. Although Mr. Collier says: "This grass has not usually been considered of much agricultural value, but it forms an important part of the native grass of the western prairies, and if cut early, forms good and nutritious hay," it can be substituted, even in the poorest sandy soils where it grows, by better grasses. It, like the *andropogons* or broom grasses, is remarkable rather for the small quantity of soluble nutritive matter and the extraordinary quantity of silicic acid it contains.

SORGHUM HALAPENSE, Johnson Grass.

This has been called Cuba grass, Guinea grass, Egyptian grass, Means grass, Alabama Guinea grass etc.

It seems pretty well agreed now however, to call this Johnson grass and leave the name Guinea grass for the *Panicum jumentorum*, to which it properly belongs. (See pp. 98–100). It is true that in Mr. Howard's pamphlet, as well as in many periodicals and books and in letters and common usage this grass has been far more generally called Guinea grass than the true Guinea grass itself, thus causing vast confusion. It is therefore assuredly time to call each by its right name. Johnson grass is perennial and has cane-like roots or more properly underground stems from the size of a goose quill to that of the little finger. These roots are, tender, and hogs are fond of, and thrive on them in winter. The roots litterally fill the ground near the surface and every joint is capable of developing a bud. Hence the grass is very readily propagated from root cuttings. It is also propagated from the seed, but not always so certainly; for in some localities many faulty seeds are produced, and in other places no seed are matured. Before sowing the seed, therefore, they should be tested, as should all grass seeds indeed, in order to know what proportion will germinate, and thus what quantity per acre to sow. One bushel of a good sample of this seed is sufficient for one acre of land.

The leaf, stalk and panicle of this grass resemble those of other sorghums. It grows on any land where corn will grow; and like the latter, the better the land, the heavier the crop. On rich land the culms attain a size of over half an inch in diameter and a height of seven feet. It should be cut while tender; and then all live stock are fond of it; for a few weeks are suffi-

cient to render it so coarse and hard that animals refuse it, or eat sparingly.

This plant is much more nutritious than the true Guinea grass as will be seen by comparing the analyses of the two made by Mr. Collier.

ANALYSIS OF SORGHUM HALAPENSE.

Oil,	2.25	Amylaceous cellulose,	25.87
Wax,	.61	Alkali extract,	15.58
Sugars,	7.37	Albuminoids,	13.18
Gum and dextrin,	6.14	Ash,	4.85
Cellulose,	25.15		
			100.00

ANALYSIS OF ASH.

Potassium,	3.68	Sulphuric acid,	2.96
Potassium oxide,	35.72	Phosphoric acid,	10.44
Sodium,	.81	Silicic acid,	22.21
Calcium oxide,	12.87	Chlorine,	4.58
Magnesium oxide,	6.73		
			100.00

A few testimonials are here quoted to give an idea of the productiveness and value of this plant. In a letter published in the Rural Carolinian for 1874, Mr. N. B. Moore, who had for more than forty years grown only grass crops, speaks of this grass under the name of Guinea grass. He says he prefers it to all others after having faithfully tried many. "It is perennial, is as nutritious as any other; when once well set, is difficult to eradicate; will grow on ordinary land and yields abundantly.

"My meadow consists of one hundred acres of alluvial land, near Augusta.... In winter I employ but four men, who are enough to work my packing press; in summer when harvesting, double that number. In autumn, I usually scarify both ways with sharp, steel-toothed harrows, and sow over the stubble a peck of red clover per acre, which, with volunteer vetches, comes off about the middle of May. The second yield of clover is uniformly eaten up by grasshoppers. The tap-root remains to fertilize the then coming Guinea grass, which should be cut from two to three feet high.... On such land as mine, it will afford three or four cuttings if the season is propitious. I use an average of five tons of gypsum soon after the first cutting, and about the same quantity of the best commercial fertilizers in March or April.... The grass which is cut before noon, is put up with horse sulky rakes, in cocks, before sundown."

Mr. Moore's income from this field was from seven thousand to ten thousand dollars a year.

Mr. Goelzel of Mobile says, "It is undoubtedly the most prof-

itable soiling plant yet introduced, and also promises to be *the plant* for our southern hay stacks, provided it can be cut every three or four weeks."

In the Rural Carolinian for 1874, Mr. John J. Delchampes furnishes the following facts and figures:

"I herewith make out a *resume* of the several cuttings of *Guinea grass* made by me last year.... The cuttings were made from one square yard of land accurately measured, and it was a fair average of the entire plot in grass.

1st cutting May 16th, weight of dry hay 19th.,	2 lbs.	8 oz.
2nd cutting June 16th, weight of dry hay 23rd.,	1	$1\frac{1}{2}$
3rd cutting July 17th, weight of dry hay 20th.,	1	$7\frac{3}{4}$
4th cutting August 18th, weight of dry hay 30th, (ruined by rain),	0	8
1st September, cut by a friend through mistake without weighing.		
5th cutting October 1st, weight of dry hay 8th.,	0	10
Total,	6	$3\frac{1}{4}$

"Reckoning the acre at 4,840 square yards, for convenience, the result is over fifteen tons of dry hay per acre, twelve days' growth being lost by an accident, and the season not a favorable one.

"I dug the roots from the same square yard of ground in January and the weight was 2 lbs., 10 oz., equal to 6.45 tons per acre. Hogs devour these roots as eagerly as they do sweet potatoes. Six and a half tons of hog feed and fifteen tons of good hay I should regard as a very good result from one acre of land. It may be well to add that on the square yard of ground from which I dug the roots, the grass is as thick now as on any other part of the plot."

Two pounds and a half of dry hay per square yard shows Mr. Delchampes' first cutting to have given him 12,000 pounds. Well may another writer exclaim: "If you want grass—*a* grass—*the* grass—and have rich land—this is just the thing to fill the bill."

If a farmer want his land for other crops, he should not plant this grass. But if he want a grass field to continue indefinitely and to yield heavy crops year after year without resetting this is the best thing he can plant.

With the ground rich and in good condition and warm, a bushel of good seed broadcast in April will take possession and keep down other plants. Without these conditions, the seed should be sown in drills sufficiently far apart to admit of cultivation once or twice. Or if roots be used, the pieces should be placed one or two feet apart in the rows, and the latter two feet apart, so as to allow cultivation. In either case the plants will soon have and hold possession. The seed may be sown also in August or September.

In south-west Mississippi where this grass was planted more than fifty years ago, where the fields were vacated during and after the civil war, it disappeared, except in spots inaccessible to stock. It shows little tendency to spread much, and some planters of longest experience, consider it not very troublesome in cultivated fields. Poor cultivation, however, only spreads and multiplies it.

Since writing this account of Johnson Grass, the following letter has been received:

Alabama Hay Farms,
Marion Junction, Dallis Co. Ala.,
July 20th, 1880.

D. L. Phares, Esq.,

My Dear Sir:—Your favor of the 2d inst., asking me to write you my experience with, and knowledge of the Johnson Grass, came duly to hand. It gives me pleasure to respond to your wishes, and through your proposed work on Grasses, to give the farmers of the United States, a knowledge of this grass which I consider stands at the head of the list of grasses for this country, especially the southern part of it. After an experience of five years in raising it and shipping the hay made from it, my earliest opinion of it is more than confirmed, its value as both a grazing and hay grass not being equaled by any other in this country. It belongs to the Sorghum family, bearing a close resemblance to chicken corn in its stalk and seed. It is perennial, of rapid growth, containing much saccharine matter, very nutritious and eagerly sought after by stock of all kinds.

It is not a new grass as supposed by many, but only of late years made available as a grass for hay. It has been upon this farm, (the Johnson place) for nearly forty years. The most reliable history I can obtain of it is this: Gov. Means of South Carolina obtained some of the seed from Turkey as early as 1835 where it was called Guinea grass. He planted it on his plantation, where it is still called Means grass. In 1840 or 45, Wm. Johnson of this place being in South Carolina, brought some of the seed with him and sowed upon his farm here, whence it derived the name of Johnson grass, by which it is now most commonly known. The botanical name is Sorghum halapense, while the Guinea grass grown in Jamaica is known as Panicum jumentorum.

The Johnson grass is of rapid growth, springs up early in the spring, and continues growing until frost, being less affected by drought than other grasses. It is propagated by both roots and seed, the former penetrating to the depth of three or four feet, reaching the moisture, which is so essential for grass culture. On good soil the yield is from one to two tons to the acre and can be cut three times during the summer. With fertilizing, the yield could be largely increased, and one more cutting per

annum. On this place I sowed this season a crop of oats, which but for the rust could have been cut in June. I have already cut from a portion two crops of hay and will cut another in Sept., making four crops from same ground in one summer.

The proper time for cutting for hay is just as the grass comes into bloom, when 24 to 30 inches high. If left to grow larger it becomes woody, and not so good for hay.

The usual quantity sown to the acre, is one bushel sown in September or October, or early spring, when sown in the early fall, it gets good root and will give two good cuttings the first season. The richer the soil the greater the yield. While grass may be enemy to cotton raising, it has proved to be much more profitable than cotton. It is not as hard to get rid of as many suppose. A neighbor here in August and September, 1878, broke up some 15 acres which he has for two years successfully planted in cotton, with no trouble from the grass.

Thousands of acres of land are yearly lying idle, which are worn out for cotton and corn, containing all the essentials for a crop of grass or grain. A field of ten acres of this grass would keep the work stock in excellent condition, and save largely in the consumption of corn.

If one half of the land now in cotton were in grass, more money could be made than is now made in cotton. The value of grass culture is well stated in the old English proverb, "no grass, no cattle; no cattle, no manure; no manure, no grass." No better stock country than the south can be found, taking all things into consideration; where one kind of grass may fail, there are others which will succeed. In this Johnson grass, a kind Providence has given the south a mine of wealth, which could easily be made a foundation for wealth and prosperity such as the south has never seen.

It may not be out of place here to call attention to the manner of putting in grasses. Frequently the seeds are sown too deeply, thereby losing the seed and blaming the seedsman. Experience shows the necessity of plowing the ground thoroughly. Then with a good harrow pulverize the soil, making a good seed bed. Sow one bushel of Johnson grass seed per acre, and brush it in, covering lightly. If preferable use a roller which will not cover as deeply perhaps, as a brush. The roller also prepares the ground for the mower.

Experience tells me that I cannot too highly recommend the Johnson grass. * * *

I am truly yours,

HERBERT POST.

Mr. Post does not overdraw the yield or value of this grass.

By scarifying and applying fertilizers his crops would be very much heavier, but perhaps not so choice from being coarser.

Euchlœna luxurians, Teosinte, or Guatemala Grass.

Within a few years this large and very beautiful tropical grass has been introduced into the south of France, the Royal Gardens, Kew, England, and thence into the East and West Indies, Australia, Tropical and South Africa, Cyprus, the Bahamas etc., and later into various parts of the United States.

It is specially interesting as allied to, and in some respects closely resembling Indian corn. It has the male flowers in a tassel at the top of the stalk, and pistillate at the joints like corn, the latter, or the seed inclosed in a loose involucre and arranged on a slender spike, as we sometimes see also in the Indian corn; though the now recognized normal arrangement of the latter seems to be in lines on a cob as though the many single slender spikes were consolidated into a large compound one; yet so often found variously forked or branched and many spiked (and we have seen one variety with every grain enclosed in its own separate shuck or husk), as to suggest a tendency to return to an earlier arrangement more in harmony with teosinte. It tillers enormously; and in one or more varieties of Indian corn we find a decidedly singular tendency, though not so strongly manifested.

It has many large blades and the stalks grow from six to fifteen feet high. Experiments made by the chemist of the Dept. of Agriculture show that the stalks contain a large quantity of sugar.

Prof. Asa Gray, in the American Agriculturist for August, 1880, speaking of this plant, writes: "The Director of the Botanic Garden and Government Plantations at Adelaide, S. Australia, reports favorably of this strong growing, corn-like forage plant, the *Euchlœna luxurians*; that the prevailing dryness did not injure the plants, which preserved their healthy green, while the blades of the other grasses suffered materially. The habit of throwing out young shoots is remarkable, 60 or 80 rising to a height of 5 or 6 feet. Further north, at Palmerston, (nearer the equator), in the course of 5 or 6 months, the plant reached the height of twelve to fourteen feet, and the stems on one plant numbered 56. The plants, after mowing down, grew again several feet in a few days. The cattle delight in it in a fresh state; also when dry. Undoubtedly there is not a more prolific forage plant known; but, as it is essentially tropical in its habits, this luxuriant growth is found in tropical or subtropical climates. The chief drawback to its culture with us will be that the ripening of the seed crop will be problematical, as early frosts will kill the plant. To make the Teosinte a most useful plant in Texas and along our whole south-western bor-

der, the one thing needful is to develop early flowering varieties, so as to get seed before frost. And this could be done without doubt, if some one in Texas or Florida would set about it. What it has taken ages to do in the case of Indian corn, in an unconcious way, might be mainly done in a human life-time by rightly directed care and vigorous selection. Who is the man who is going to make millions of blades of grass grow where none of any account ever grew before?"

In the southern cultivator for October, 1879, a writer from Milledgeville, Ga., under date of Sept. 7th., 1879, says that from a few seeds planted March 20th. he saved one plant, which "from a small, almost triangular seed has developed a plant now 9 feet high and 4 feet in diameter, with something over 80 stalks, and which no cow in the State could consume at a single meal. It tillers from the very start, spreading horizontally for some weeks before beginning a perpendicular growth." It showed no signs of blooming; and six plants obtained from seed planted in June would not attain one-third the size of this by frost.

On 16th. July, 1880, Mr. A. Wikas at the Menelas farm, Brookhaven, Miss., writes me: "We planted in March, April and May, 2 and 3 feet apart each way in hills, and it grows equally well, The leaves resemble very much those of corn, and while at first it comes only a stalk, it shoots afterwards and multiplies from 25 to 50. We think it can be cut 3 or 4 times when $2\frac{1}{2}$ to 3 feet high. We planted the first on the 5th. of March and although it is now about 6 feet high, yet there is no sign of blooming."

A part of this crop was not cut; but after blooming, when 12 to 15 feet high, was killed by frost. It was in this condition when I saw it. The stems were as large as those of maize, blades and tassel all so like those of latter that the one plant might be easily mistaken for the other. I am convinced that seeds of the teosinte can be matured in parts of Texas and Florida and also with little protection, in south Mississippi, Louisiana and Alabama. It has a large number of large, long, strong fibrous roots penetrating the soil deeply,

On land well adapted to it, I think it would not be difficult to produce one hundred tons per acre. And as it contains a large per centage of sugar besides other nutrients, it may be made one of the very best, most profitable and desirable crops in the southern States for ensilage.

ZEA.

Z. MAYS. Indian Corn, Maize. Well may this plant be called *zea*, LIFE; since it has become so essential and so large an element in sustaining the lives of men, beasts and birds, domes-

ticated and wild, besides hosts of insects feeding on the roots, stem, pith, leaves, blossoms and seed green and ripe. Where can another plant be found feeding and keeping alive such a number of genera, species, tribes and hosts of living creatures?

Annually it is adapting itself to other localities and seems destined to become almost cosmopolitan and thus the "staff of life" to numerous other tribes of living beings!! Yet what countless millions of dollars are annually sent from Europe and from our own southern States for the purchase of this cheap supporter of life!!! What the depth of dependence and poverty into which the southern States are voluntarily plunging themselves, by skimming away the essence of the soil and pouring their hard earnings in golden streams into the coffers of the western corn growers!

The varieties of corn almost numberless adapting it to all soils and many climates and to many special purposes, and the modes of culture are so varied by differences of soil, climate and objects, that our space will not admit of their discussion. Nor can we consider in detail the valuable medicines furnished by this plant, nor the virulent poisons developed upon and from the grain.

Whether corn be planted for the grain or for fodder, in rows, drilled, checks or broadcast, the land should first be broken very deeply, but without turning up much clay. It should have repeated plowings and harrowings if necessary to put the ground in a light, mellow condition. Planted on land so prepared, a crop may be made almost without any rain; each stalk, not too much crowded, throwing out innumerable fibrous roots with an aggregate length of many thousand feet, and (where under the well prepared soil the sub-soil can be penetrated) to a depth of several feet beyond that generally imagined.

In one neighborhood this year, (1881), a crop of corn planted on very old land prepared as above described has yielded four times as much as any other in the whole region. This was planted later than other fields and never had rain to lay the dust; while others having an earlier start and some of them plenty of rain have yielded very little. Most of the labor required for making a good crop of corn on old land in the south, should be expended before planting. With such preparation the plants grow rapidly and need much less work; and often make a large yield with no labor after planting. Employing this mode of preparation, since 1851, I am convinced that in most parts of the south a fair corn crop can be made every year whether there be rain or not, on clay soils.

No other plant is so much and so generally used in the southern States for forage—a vast number of planters depending solely upon corn, stalk, blade, husk, (or shuck), grain and even cob;

all containing much nutrition. The fodder of blades and the ears are very convenient for feeding, and the green plant is one of the best for ensilage.

COIX.

C. LACRYMA. Job's Tears, Corn Beads.

This plant is cultivated to a limited extent; but it has no agricultural value, notwithstanding its branching stems and broad leaves. Its fruit is interesting, consisting of a fertile spikelet enclosed in a consolidated involucre which becomes ossified, very hard, polished and perforated so as to be used for beads. And this is about the only use found for it; for these beads are too bone- or horn-like and indigestible to serve as food.

CHAPTER X.

Miscellaneous.

A few other forage plants, omitted in their regular order as little cultivated in the southern States, yet too important to ignore wholly, are briefly mentioned here. The several species of mustard, (*Sinapis*), are worthy of some care as stock-food. The several species of *Brassica* with its many varieties of turnips, cale, ruta-baga, cabbage, cauliflower, broccoli etc. are very valuable, as are also the various beets and magelwurtzels. The leaves of all these plants are relished by live stock as are also the fleshy roots. They are valuable at all times but especially in the winter, when succulent food is so much needed by live stock. Immense crops of these fleshy roots may be produced on a single acre of land and they are not difficult to preserve during winter.

COTTON SEED.

This one of the most valuable of nutrients produced on any farm, demands a paragraph. It is very valuable in the crude state as it falls from the gin-stand, for feeding cows, sheep and swine. Five or ten cents worth with a little hay or grazing will keep a large sheep in fine condition all winter. A few serve to keep hogs in good condition at all times.

In feeding they should be scattered thinly on the ground or mixed with other feed to prevent the animal taking too large quantity in the mouth and endangering choking. They may be wetted, and better boiled for hogs; but never rotted. Mules sometimes take to them and continue in good condition. De-

corticated, they are still better for all animals. The cake after expressing the oil is not surpassed as a feed for sheep, hogs, cattle, horses and mules, by any thing else. Being concentrated food it must be fed with discretion and mixed with abundance of coarser foods as grasses, hays and matters containing little nutrition. It is far more valuable than Indian corn.

CHAPTER XI.

Planting.

It had long been believed both North and South that the "artificial" or cultivated grasses and clovers could not be induced to grow here. There never was a greater mistake; for most of them grow spontaneously in the South where partially protected, and some of them without any protection against stock. It has been to the interest of western farmers to teach that the grasses could not be grown here. The ill success of many southern planters in their feeble attempts to grow them confirmed the opinion. Now, many of these men did not deserve success. The plow is started and the sod set up edgewise like the folds of a palm leaf. The seeds (very small, some of them almost microscopic), are sown and a harrow run over the ground. Most of the seed are covered too deep to ever germinate. The few that sprout, find it difficult to live among the clods and finally die out; smothered by weeds on the richer spots and starved on the poorer.

Preparation of the Land.

No one should plant grasses and clovers, unless he determines to do it right. The ground must be plowed and harrowed, and the process repeated as many times as may be necessary to put the surface and sub-soil in proper condition. The subsoil should be broken and loosened; the deeper the better, but *not turned up*. The surface of the ground should be finely comminuted and smoothed. If too light, the roller should be used for compacting. When the ground is properly prepared, it should be very lightly marked off in lands of such width as may be convenient to sow. For an acre so laid off, take the proper quantity of seed, divide into as many parcels as lands: then sub-divide each parcel into two equal parts. With one of the smaller parcels, proceed from one end to the other of the land, sowing; then returning over the same land, sow the other half; and so on throughout the entire field. Thus an equal distribution of seed may be effected and an even stand of plants obtained.

Grass seed should never be sown while the wind blows; but if this cannot be avoided, the next best thing to do, is to travel with the wind in sowing. But even this can never give an even or tolerably satisfactory distribution of seed.

After sowing the seed never use harrow, or brush or other device, for covering. In some cases the roller may be used; but it is seldom needed. I have tried all the methods; and I have had best success by leaving the seed to be beaten in sufficiently by rain. My best success with blue grass has been on unbroken ground, the leaves only raked away and leaving a rather smooth surface.

Once I burned off leaves and trash from a wooded lot and immediately sowed blue grass seed in March. They came up very promptly; and in a few months the grass had attained a larger growth than I had ever before seen at two years old.

SIZE OF SEEDS AND DEPTH OF COVERING.

In order to understand clearly the danger of harrowing in grass seeds, let a few things be considered touching some of the best known forage plants. Red clover has 256,000 seed to the pound, English blue grass or meadow fescue 400,000 and Tall oat grass 340,000; these small seeds germinate badly if buried deeper than a half inch in the lightest, fine soil. White clover with 500,000 seed to the pound, and Orchard grass with 640,000 find it difficult to get up when covered one-fourth of an inch. What then shall be the depth of covering for Timothy seed of 1,184,000 to the pound, Soft meadow, or velvet grass with 1,500,000, Red top with 6,800,000 and White top with 8,000,000 seeds to the pound? From these statements the utility—the necessity of the roller preceding on loose soil the sowing of light, minute seeds will at once be appreciated, as also the danger of harrow or brush after sowing. With a heavy, badly prepared soil the danger from the harrow is much enhanced; for covering these seeds one-fourth or one-half inch deeper than above mentioned the bulk of them never germinate. The failures from too deep covering are frequent and lead to unjust suspicions and charges against seedsmen.

THE TIME TO SOW

must be determined by each one's own judgement. The orchard, red top, blue, timothy, velvet and Italian rye grasses may be sown any time from the first of September till the middle of March with success, or again with total failure. Each must be governed as to time of sowing by telluric and atmospheric conditions. It is worse than useless to sow on a parched ground, or during a drought. If the ground be moist

from the surface down to perpetual moisture, and there be a reasonable prospect of its continuing so by rains or otherwise long enough for the seeds to germinate and take root, sow; the earlier the better. I have succeeded in all the months indicated. But as I expected, I had some failures—not so many however, as I was prepared to expect. If one carefully observe these directions, he will rarely be disappointed in results.

In order to have a good crop the first year, it is important to sow in the fall, if the proper conditions concur; and especially so for the velvet and rye grasses. By autumnal sowing, too, one can have opportunity of seeding in January, February or March, any spots on which there may be a defective catch.

All that I have said in regard to preparation of ground, times and mode of sowing is equally applicable to the Medicagos, Melilots and Trifoliums, or the clover family; except that lucerne succeeds better by sowing in drills twelve or fifteen inches apart, so that it can be cultivated the first year. It is difficult to succeed in any other way with lucerne. All these seeds can be sown satisfactorily only when the air is motionless. For sowing all grass and clover seeds, small grain of all kinds, peas, etc., broadcast, Pearce's improved Cahoon hand sower is a most admirable implement, very cheap, the work light and expeditious. It is fully what it professes to be. For sowing very large areas horse machines may be used.

The various millets and other larger grains should be harrowed or rolled, or both after sowing; the preceding paragraphs having reference only to the smaller seeds, which often sink too deep in loose land to get out even when not harrowed.

For an Orchard

I know no better combination than red clover and orchard grass. Both fertilize and otherwise improve the land. The seeds of timothy or clover should

Not be Mixed

with those of grasses before sowing. While sowing, the heavy, smooth clover seeds will accumulate at the bottom of the container and the lighter grass seeds rise to the top, so that parts of the field will show only grass and other parts clover alone. If possible to keep them mixed in the bag, the same cast will scatter the clover seed over ten times more surface than the grass seed can be made to reach. Seeds of different specific gravity, size or smoothness, should not be mixed together for sowing; but first one sown, then another.

To Keep Down Weeds

in an orchard use the mower as often as necessary, turn in calves and sheep whenever proper, and pigs during fruit season. Calves and sheep destroy young or small trees and must not

have access to them. These animals are about the best exterminators of briers, cane and underbrush. Old hogs sometimes destroy small fruit trees especially the plum, by tearing the bark with their teeth in shaking off the fruit.

WHAT ARE THE BEST GRASSES FOR WINTER PASTURES?

This depends on whether the pasture is for one season, or to be permanent, as well as on location, soil, drainage, etc. For a single winter, the testimony, so far as known to me, is unanimous in strong commendation of our native wild brome grass, (Bromus unioloides). Many however, speak from a single experiment, and with little or no knowledge of other grasses. So that we must accept these statements with due reserve and caution. Two winters it gave me luxuriant, tender grazing from October till April or May; but next winter it was three months later, not coming up till November, and not ready for grazing till the middle of January. Others inform me that seed grown here do not germinate till November, and that for early fall pastures, seed must be imported annually from Southern Europe. But this I know is not necessarily so; for it is indigenous in our southern States, and I have seen good grazing early in October from native seed. It depends on character of the season.

Several other plants furnish good winter pasture, but none are so valuable as barley. I have year after year sown wheat, oats, rye barley, etc., side by side, for winter pasture; and 20 years ago I reached the conclusion, that barley was more valuable than all others. It affords grazing earlier, more abundantly, grows sooner and more rapidly after being grazed down, is more relished by stock and more wholesome. It does not lie on the ground like rye, but stands up; so that stock eat less sand, dirt and other unwholesome matters in grazing it. With me, when all other kinds of grain were destroyed by rust, it was never affected by that or any other disease, or contingency of weather.

It is gratifying to see in the Southern Cultivator, from the pen of its experienced, cautious and very able editor, a like estimate of the value of barley for winter pasture; sown in August or September, it affords good grazing from October till May. If stock are taken off in March, a good crop of seed may be harvested; or if not all desired for seed, swine may be turned on it, and for a month or two, probably nothing could benefit them more. Sow three bushels per acre.

FOR PERMANENT PASTURES,

a mixture is necessary, and a few mixtures are here given as samples; but they may be much varied:

1. On marshy lands; Red top 6 lbs., Tall fescue 8, Fowl meadow 10, Rough stalked meadow 7, Reed Canary 4, White clover 8, and probably our native Canary.

2. For rich dry creek bottom or cotton land; Orchard 8, Meadow fescue 3, Hard fescue 4, Perennial rye grass 7, Italian rye grass 5, Tall oat grass 4, Yellow oat grass 3, Sweet scented vernal 3, Rough stalked meadow 3, Red clover 3, White clover 3, Blue grass 4.

3. On hill side, and specially if sandy or gravelly; Orchard 8, Sweet scented vernal 12, Tall oat grass 7, Downy oat grass 5, Yellow oat grass 5, Hard fescue 5, Red top 10.

4. For loamy hill top or table land; Orchard 8, Kentucky blue grass 5, Meadow fescue 3, Perennial rye grass 5, Italian rye grass 5, Red top 2, Tall oat grass 3, Sweet scented vernal 3, Red clover 4, White clover 5.

5. For open woods with good soil; Kentucky blue grass 5, Orchard 8, Hard fescue 5, Nodding fescue 5, Rough stalked meadow 5, Wood meadow 5, Sweet scented vernal 3, Red clover 4, White clover 4.

6. Another mixture for woodlands may consist of several species of fescue, each 4, Tall oat grass 4, Yellow oat grass 5, Terrell grass 8, Blue grass 5, Orchard grass 7 pounds.

To no. 1, barn yard grass, (Panicum Crus-Galli), may be added also Panicum agrostoides and proliferum. To nos. 2, 3 and 4, native Paspalums found all over the southern States, very hardy, very nutritious, very toothsome to stock throughout summer may well be added.

One of the very best of naturalized grasses, both for pasture and meadow is the Bermuda. It would do well on any good land, not marshy. I have seen Red and White clovers do well among it; and possibly some of the grasses named above might do equally as well, such as the oat grasses, red top, or wild brome.

The quantities given in above mixtures are for a single acre, and may seem large, but to obtain good pastures, heavy seeding is absolutely necessary, though expensive. These mixtures, too, are arranged with a view to a variety and succession of grasses throughout the entire year for grazing.

We have many very valuable natural pastures or commons well set with Eleusine, Dactyloctenium, Panicum sanguinale, anceps and others, Paspalum præcox, læve, undulatum and others, Sporobolus, Cynodon, Muhlenbergias, Andropogons and other grasses, Corices, etc., affording good natural grazing most of the year.

DEFECTIVE SEEDS

render heavy seeding necessary—sometimes from ten to ninety per cent. of the seeds purchased failing to germinate. It is well to test every lot of seed before sowing, to ascertain what per

centage will germinate, and to sow accordingly. And as seeding a large farm is very expensive, with bought seeds, it is a good plan to have separate lots, each with picked seed of a single grass, for the purpose of propagating such sound seeds as we may wish for mixtures or other purposes. Thus a large area may in a few years be satisfactorily set in grasses at moderate cost. Grass seeds should be carefully examined and tested before planting for another reason; viz: they are often mixed with seeds of undesirable and pernicious plants. Sometimes they are manufactured of wood and other materials and colored; or old worthless seeds are colored to resemble the fresh or new seeds.

MEADOWS.

The remarks made on Bermuda grass, Johnson grass, Tall oat grass, Orchard grass and Red clover, I trust will suffice for this head. The paspalums are also good meadow grasses that re-seed the land annually. I have seen a valuable meadow of these grasses alone mown for a series of years. The grass both green and dry; is much relished by stock, and very nutritious. (See pages 86–88).

CHAPTER XII.

The Silo and Ensilage.

It is but a few years since the advent of these two words into American agricultural literature, yet to-day a work on Forage Plants would be deemed incomplete without some mention of them. *Silo* is properly a pit though now sometimes constructed partly, sometimes wholly above ground. *Ensilage* is the process of preparing and preserving green forage *en silo*, that is by ensilaging or empitting. The word is used to designate also the forage itself so prepared.

THE PROCESS.

Maize, being most frequently used for making ensilage, may be conveniently taken to illustrate the process. At a proper stage of growth the whole plants are cut near the ground, hauled to the silo, cut into short pieces, throwned into the pit and tramped down by men as thrown in. This process is continued till the pit is filled and the cut forage piled and tramped far above the top of the silo. Then it is covered and heavy weights placed on top—100 to 200 pounds per square foot. It soon shrinks about one-third to one-half and if rightly managed

till all is within the silo. The covering and pit must be as nearly air tight as practicable. This is in few words the whole process of making ensilage.

THE SILO.

This may be dug in the level ground, or in the side of a hill, and should be as near as possible to the stalls where the forage is to be used—best under the same roof to prevent exposure of stock and men when feeding in inclement weather and to save carriage. In rock and some clays, the silo will need no lining; but in most places, the sides and bottom should be cemented, or lined with plank, or walled up with stone or brick. Or it may be made only partly under ground, or even wholly above by raising walls sufficiently thick of brick, stone or concrete. If above ground the walls should be thick and strong, well braced and banked with earth. The size will depend upon the wishes of the farmer and may be readily calculated by any one. Well prepared ensilage will weigh about 45 pounds to the cubic foot, or about 56 pounds to the bushel; equal to about 80 bushels for every 100 cubic feet. So that a silo ten feet deep, 10 feet wide and 10 feet long will hold 45,000 pounds or $22\frac{1}{2}$ tons or 803 bushels. Every foot of length then of such a silo will contain 80 bushels or $2\frac{1}{4}$ tons of matured ensilage. The number of bushels any silo contains may be easily found by obtaining the number of cubic feet and deducting therefrom one-fifth; the remainder denotes the number of bushels. Thus, if a silo contain 1,000 cubic feet it holds 800 bushels; if 70 cubic feet 56 bushels. The silo may be constructed of logs with the spaces well chinked with clays or it may be made as the house described for sweet potatoes on page 28. But these methods are not so safe. The ensilage, when the silo is filled should be covered with a layer of straw from six to fifteen inches in thickness, then with planks two inches thick and of such length as to move down inside as the ensilage settles. On the plank stone or other weights should be placed. In the south it would be safer to cover the plank with ten to fifteen inches of earth well packed; and if so covered the straw will not be required. As the forage settles, the earth on top should be trodden to close fissures and kept air tight. In this way ensilage has kept sound two years.

VALUE OF ENSILAGE.

Opinions on this subject vary considerably. But the results of many carefully conducted experiments show little or no loss of nutritive matter in changing green corn into ensilage when the corn is cut fine, or in lengths of three-eighths of an inch and closely packed so as to expel the air as perfectly as possible.

Both chemical analysis and the results of feeding confirm this statement. If the corn stalks or other plants are put in whole there is great loss; for no amount of practicable pressure can be applied sufficient to expel the air and prevent much decomposition.

When the ensilage is properly prepared feeders contend for increase in its value. And it is no doubt much more valuable than the same matter would be if dried for winter and spring feeding. by using it animals require very much less water than when fed on hay, as the latter contains only about one-seventh as much water as the ensilage. The water in the ensilage is warmer than that in ponds and streams and abstract little or no heat from the animal and thus much is saved; while the heat absorbed by the cold water and out door air must be replaced by more carbohydrates in the daily ration of the animal. Part of the material in the ensilage is rendered more digestible and easier to assimilate by the slight fermentation which takes place in the silo. If packed as above directed very little air can remain in the silo, and as soon as the oxygen in that is combined in fermentation with carbon, the fermentation must cease both for want of oxygen, from the pressure of the carbonic acid and the anti-fermentative power of the latter.

To be thrifty our live stock especially the young and growing require succulent food: and by means of ensilage it is cheaply obtained. But corn stalks alone green or dry do not furnish all the materials needed by animals for growth and fat in winter and summer. Hence the necessity of some additional food. A good ration for winter is for every 500 pounds live weight 20 pounds corn ensilage and 3 pounds corn meal or cotton seed meal or oil cake per day. Wheat bran in small quantity may be used also; but it is too poor to use to much advantage with ensilage. Shorts would be better. Corn, barley, rye or oats could be advantageously used with it, the first two especially.

ENSILAGE PLANTS.

Green corn has been most generally used. Teosinte would probably be fully as valuable and vastly more productive. Both these plants, having large stems and near the bottom hard shells, should be cut in pieces not over three-eighths of inch long. When cut too long the woody parts often turning endwise between the jaws wound the gums and tongue and cause very serious damage to the animals. All plants for ensilage are better cut when in bloom and on till the seeds begin to glaze. The southern white corn has been extensively and successfully used for ensilage. Perhaps some of the more prolific, softer shelled kinds would be better. The sugar corns are richer but smaller. The pea vine, millets, Johnson grass, sweet potato

vines, beet tops and roots and many other things would make good ensilage. The prickly comfrey might be made very useful in combination with pea vines or corn by facilitating a closer packing. But all should be cut short to ensure close packing.

FEEDING.

The silo should have movable partitions of plank. When the ensilage is to be used it should be cut from top to bottom and the partition moved up close and propped against the perpendicular mass. By means of these partitions a part of the silo may be filled at one time, and other parts later. Attempting to fill too great a length at once might cause great loss, for the corn or other plant must be cut rapidly and hauled as fast as cut and worked up without delay so as to prevent wilting. It seems to do better to fill only a foot or two a day than more, thus giving time to settle better.

Excellent machines are now made for cutting corn and other plants into thin slices at the rate of many tons a day, the length adjustable from a quarter of an inch to one or two inches. The expense of corn ensilage is much less than that of the same quantity prepared in any other way.

TABLE I.

Proximate Composition of Agricultural Products, showing the average quantity of Water, Ash, Crude Fibre, Albuminoids, Carbohydrates, etc., compiled from Wolff, Knop and others.

SUBSTANCE.	Water.	Ash.	Crude Fibre.	Albumin-oids.	Carbohy-drates, Etc.
ROOTS AND TUBERS.					
Potato Irish	95.0	0.9	1.1	2.0	21.0
Artichoke Jerusalem	80.0	0.9	1.3	2.0	15.6
Kohl Rabi	88.0	1.2	1.2	2.3	7.3
Field Beets, Mangold	88.0	0.8	0.9	1.1	9.1
Sugar Beets	81.5	0.8	1.3	1.0	15.4
Ruta Bagas	87.0	1.0	1.1	1.6	9.3
Carrot	85.0	1.0	1.7	1.5	10.8
Giant Carrot	87.0	0.8	1.2	1.2	9.8
Turnips, (Swede)	91.5	0.8	1.0	0.8	5.9
Turnips	92.0	0.8	1.0	1.1	5.1
Parsnip	88.3	0.7	1.0	1.6	8.4
Pumpkin	94.5	1.0	1.0	1.3	2.8
SEEDS.					
Rice	14.6	0.5	0.9	7.5	76.5
Winter Wheat	14.4	2.0	3.0	13.0	67.6
Rye	14.3	2.0	3.5	11.0	69.2
Barley	14.3	2.4	8.0	9.0	65.9
Oats	14.3	3.0	10.3	12.0	60.9
Maize	14.4	2.1	5.5	10.0	68.0
Millet	14.0	3.0	6.4	14.5	62.1
Buckwheat	14.0	2.4	15.0	9.0	59.6
Vetches	14.3	2.3	6.7	27.5	49.2
Peas	14.3	2.5	9.2	22.4	52.3
Beans	14.5	3.5	11.5	25.5	45.5
Lentils	14.5	3.0	6.9	23.8	52.0
Lupins	14.5	3.5	14.5	34.5	33.0
Flax seed	12.3	5.0	7.2	20.5	55.0
Rape seed	11.0	3.9	10.3	19.4	55.4
Hemp seed	12.2	4.2	12.1	16.3	55.2
HAY.					
Meadow hay	14.3	6.2	30.0	8.2	41.3
Aftermath	14.3	6.5	24.0	9.5	45.7

TABLE I continued.

SUBSTANCE.	Water.	Ash.	Crude Fibre.	Albuminoids.	Carbohydrates, Etc.
HAY continued.					
Red Clover, full blossom	16.7	6.2	35.8	13.4	29,9
" " ripe	16.7	5.6	48.0	9.4	20.3
White Clover, full blossom	16.7	8.5	25.6	14.9	34.3
Alsike Clover, blossom,	16.7	8.3	30.5	15.3	29.2
" " ripe	16.7	5.0	45.0	10.2	23.1
Lucern, young	16.7	8.7	22.0	19.7	32.9
" in blossom	16.7	6.4	40.0	14.4	22.5
Esparsette, in blossom	16.7	6.2	27.1	13.3	36.7
Crimson Clover "	16.7	7.2	33.8	12.2	30.1
Yellow Medick "	16.7	6.0	26.2	14.6	36.5
Vetches "	16.7	8.3	25.5	14.2	35.3
Peas "	16.7	7.0	25.2	14.3	36.8
Italian Rye grass	14.3	7.8	16.9	8.7	51.4
Timothy	14.3	4.5	22.7	9.7	48.8
Early meadow grass	14.3	2.4	25.9	10.1	47.2
Crested dog's-tail	14.3	5.5	22.6	9.5	48.0
Soft brome grass	14.3	5.0	31.0	14.8	35.0
Orchard grass	14.3	4.6	28.9	11.6	40.7
Barley grass	14.3	5.3	27.2	9.6	42.0
Meadow fox-tail	14.3	6.7	29.0	10.6	39.5
Tall oat grass	14.3	9.9	29.4	11.1	35.3
English Rye grass	14.3	6.5	30.2	10.2	38.9
Sweet vernal grass	14.3	5.1	31.2	8.9	40.2
Velvet grass	14.3	5.5	33.6	9.9	36.7
Kentucky blue grass	14.3	5.1	32.6	8.9	39.1
Rough meadow grass	14.3	7.1	32.6	8.4	37.6
Yellow oat grass	14.3	5.9	30.8	6.4	42.6
Quaking grass	14.3	7.4	30.3	5.2	42.8
Average of the grasses	14.3	5.8	28.7	9.5	41.7

TABLE II.

ABRIDGED FROM AGRICULTURAL DEPARTMENT REPORT FOR 1879.

NAME OF PLANT.	Water.	Ash.	Fat.	Nitrogen free extract.	Crude fibre.	Nitrogen x 6.25, albuminoids.	Nutritive ratio.	Val. per ton of dry substance.	Val. per ton as hay with 14.3 per cent moisture.
Common Vetch. Vichia sativa	14.3	7.71	1.53	35.26	13.06	25.14	1:1.21	28.97	24.83
Beggar lice. Desmodium molle	14.3	6.65	2.38	38.76	21.72	16.25	1:2.5	21.02	18.01
Japan clover. Lespedeza striata	14.3	3.88	3.76	14.82	20.32	12.92	1:3.8	20.35	17.44
Blue thistle. Echium vulgare	14.3	5.82	2.30	53.19	19.01	5.38	1:10.3	14.77	12.66
Ribwort plantain. Plantago	14.3	6.42	3.82	47.52	18.82	9.12	1:5.6	17.83	15.20
Mexican clover. Richardsonia	14.3	7.16	2.65	45.18	25.59	5.12	1:9.3	13.40	11.48
Satin grass. Muhlenbergia glomerata	14.3	12.87	1.94	35.32	15.15	17.42	1:2.3	23.13	19.82
Knot grass. "	14.3	5.43	3.20	46.07	19.52	11.48	1:4.3	19.03	16.31
Dropseed grass. " diffusa	14.3	7.95	1.55	47.44	20.19	8.57	1:5.7	15.83	13.57
American canary grass. Phalaris	14.3	9.99	3.52	37.23	21.29	13.67	1:3.0	19.49	16.70
Vanilla grass. Hierochloa	14.3	7.99	3.18	42.38	19.73	12.12	1:3.8	19.12	16.39
Schrader's grass. Bromus unioloides	14.3	8.35	3.07	44.97	17.64	11.67	1:4.0	18.77	16.08
California broom grass. " carinatus	14.3	9.32	2.30	42.67	22.91	8.50	1:5.3	15.48	13.27
Common Cheat or chess. " secalina	14.3	6.10	3.49	49.11	20.39	6.61	1:8.2	17.03	14.59
Yard, or crow-foot grass. Eleusine	14.3	16.49	1.83	29.15	26.58	11.65	1:2.6	13.41	11.49
Bermuda grass. Cynodon	14.3	7.81	1.34	45.09	19.96	11.50	1:4.0	17.62	15.10
Smut grass. Sporobolus Indicus	14.3	6.03	2.80	44.28	22.00	10.59	1:4.4	17.35	14.87

Panicum gibbum	14.3	7.31	3.56	43.65	20.71	10.47	1:4.5	18.08	15.49
proliferum	14.3	9.58	2.58	43.42	20.63	9.49	1:4.8	16.59	14.22
sanguinale. Crab grass	14.3	10.81	2.42	36.59	27.50	8.38	1:4.7	14.45	12.38
divaricatum	14.3	12.25	2.16	40.18	23.19	7.92	1:5.7	14.51	12.43
jumentorum. Guinea grass	14.3	7.75	1.34	41.98	27.01	7.62	1:6.7	14.01	12.00
Crus-galli. Barn-yard grass	14.3	5.98	1.84	46.44	24.78	6.66	1:7.2	14.32	12.27
obtusum	14.3	9.38	1.93	39.80	28.38	6.21	1:5.7	12.93	11.08
capillare. Witch grass	14.3	4.89	3.34	47.39	24.20	5.98	1:8.5	14.97	12.83
dichotomum	14.3	8.68	3.04	42.91	25.27	5.80	1:7.9	13.89	11.90
agrostoides. Munro grass	14.3	5.73	4.88	43.59	26.45	5.05	1:9.6	14.66	12.56
anceps	14.3	7.76	1.57	47.56	23.89	4.95	1:9.9	12.99	11.13
Texanum	14.3	8.65	2.12	47.07	23.16	4.70	1:10.5	13.06	11.19
virgatum. Switch grass	14.3	4.70	2.85	48.81	24.95	4.39	1:11.8	12.63	10.82
filiforme	14.3	7.51	1.27	52.24	22.14	2.54	1:21.1	11.65	9.98
Sorghum halapense. Johnson grass	14.3	6.92	2.43	44.77	21.47	10.11	1:4.7	17.21	14.75
nutans. Wood grass.	14.3	7.86	1.40	43.12	30.58	2.74	1:16.2	10.37	8.79
Poa pratensis. Blue grass	14.3	4.46	2.45	44.96	23.94	9.89	1:4.8	17.07	14.63
serotina. English blue grass	14.3	3.63	2.43	56.40	17.87	5.37	1:10.9	15.40	13.20
compressa. Fowl meadow grass	14.3	4.46	2.95	49.00	21.73	7.56	1:6.9	16.25	13.94
Triticum repens. Quack grass	14.3	7.99	3.02	48.22	16 63	9.84	1:5.2	17.97	15.40
Uniola latifolia.	14.3	12.55	2.67	29.25	31.91	9.32	1:3.4	14.13	12.11
Festuca pratensis Fescue grass	14.3	7.83	2.81	45.07	20.78	9.21	1:5.2	16.91	14.49
ovina. Sheep fescue	14.3	4.31	3.65	72.14		5.60			
Agrostis exarata. Native red top	14.3	5.10	1.97	48.53	21.01	9.09	1:5.6	16.71	14.32
Spartina cynosuroides. Marsh grass	14.3	6.19	2.93	46.07	22.10	8.41	1:5.8	16.41	14.06
Glyceria nervata. Fowl meadow grass	14.3	5.30	2.74	45.43	24.17	8.06	1:6.0	15.90	13.68
aquatica. Reed meadow grass	14.3	6.26	1.89	48.64	21.94	6.97	1:7.3	14.99	12.85
Avena striata. Mountain oat grass	14.3	4.25	3.43	48.10	22.42	7.50	1:6.9	16 37	14.03
Tripsacum dactyloides. Gama grass	14.3	5.30	2.05	48.26	22.72	7.37	1:6.8	15.35	13.15
Bouteloua oligostachya. Gramma grass	14.3	6.69	2.67	49.58	19.41	7.35	1:7.1	15.89	13.70

TABLE II continued.

Bouteloua oligostachya. Gramma grass	14.3	6.69	2.67	49.58	19.41	7.35	1:7.1	15.99	13.70
Anthoxanthum odoratum. Vernal grass	14.3	7.22	2.92	46.12	22.10	7.34	1:6.7	15.57	13.34
Setaria setosa. Bristle grass	14.3	7.78	1.28	41.68	27.68	7.28	1:5.9	13.63	11.68
Dactylis glomerata. Orchard grass	14.3	7.23	2.99	46.92	21.35	7.21	1:7.0	15.65	13.41
Paspalum læve. Water grass	14.3	6.60	2.36	46.13	23.66	6.95	1:7.0	14.87	12.74
præcox. Early grass	14.3	6.37	3.09	49.49	21.69	5.08	1:10.3	14.46	12.39
Andropogon furcatus. Blue joint grass	14.3	4.36	2.59	49.87	21.98	6.90	1:7.6	15.62	13.39
scoparius. Broom grass	14.3	6.05	1.59	47.58	24.91	5.53	1:8.9	13.44	11.52
macrourus. "	14.3	3.21	2.18	49.87	25.50	1.94	1:10.5	13.79	11.82
argenteus. Silver beard g.	14.3	3.11	2.62	55.01	21.76	3.20	1:18.0	13.57	11.63
Virginicus. Broom grass	14.3	8.00	1.43	45.35	28.35	2.57	1:18.2	10.64	9.12
Dactyloctœnium Egyptiacum. Crow-foot	14.3	6.08	1.66	56.21	14.85	6.90	1:8.4	16.05	13.75
Tricuspis purpurea. Purple top	14.3	4.42	3.18	46.23	24.97	6.90	1:7.2	15.41	13.21
sesleroides. Tall purple top	14.3	4.46	1.73	41.84	32.33	5.40	1:8.1	12.49	10.70
Danthonia compressa. Wild oat grass	14.3	3.06	3.02	46.80	25.98	6.84	1:7.3	15.35	13.15
spicata. " " "	14.3	3.75	3.26	48.78	24.95	4.96	1:10.5	14.36	12.31
Leptochloa mucronata. Feather grass	14.3	10.08	1.76	40.06	27.20	6.60	1:6.3	13.17	11.29
Cinna arundinacea. Reed grass	14.3	5.73	2.55	46.69	25.40	5.33	1:9.2	13.82	11.84
Elymus Canadensis. Wild rye grass	14.3	5.13	3.18	43.52	29.70	4.17	1:11.2	12.79	10.96
Aristida purpurasceus. Purple beard g.	14.3	5.87	2.22	52.59	21.32	3.70	1:14.8	13.29	11.39
Scirpus eriophorus. Wooly sedge	14.3	5.87	2.57	47.41	25.87	3.98	1:12.6	12.87	11.03
Hay cut in bloom	14.3	4.26	4.61	48.06	21.60	7.17	1:6.0	17.92	15.35
Hay cut after bloom	14.3	4.20	4.50	45.64	24.81	6.55	1:7.6	15.94	13.66

The first six columns of this table show the number of parts in 100 of each substance named. The last two columns show the relative feeding values in dollars and cents.

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